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Better Marketing Methods Demand Attention

NINETEEN hundred and twenty-five met industrial hopes and expectations in the United States with a fuller measure of prosperity than any previous year in our history. The record shows that production and consumption of goods in proportion to the population reached its peak. In this happy outcome the chemical engineering industries shared proportionately to industry as a whole. There are a few in that group for which 1919 still stands as the peak of production, but for the majority the year 1923 saw substantial recovery to 1919 levels after the slump of 1921, while 1925 showed an advance beyond any previous high point.

WITH production on a basis of greater economy and efficiency, the problems of marketing continue to merit particular attention. Accordingly the keynote of this issue of *Chem. & Met.* is the marketing of chemical products. What are the characteristics of marketing in the chemical industry? What are the trade practices? Are they economical or extravagant, organized or chaotic? What products are available and how definite are the specifications? Are credits extended for long or short periods? The answers to these and other pertinent questions are valuable to producer and consumer alike in the interest of stable production and intelligent buying. Leading authorities in important industries have co-operated splendidly to set forth the facts.

SUPPORTING these contributions the editorial staff has gathered an impressive array of statistics. When *Chem. & Met.* published its First Annual Review Number in January, 1924, the motive was found in the fact that "the chemical industry is not notable for its quantitative data on production, distribution, stocks and prices, and consequently offers an inviting opportunity for journalistic enterprise." How meager were the data and how scanty the literature on this subject was not fully appreciated even by the editors until they began this pioneer cultivation of an almost barren field. It was then apparent that success would depend largely on their own initiative, with intensive efforts to gain outside co-operation in developing a body of knowledge having economic significance.

THAT substantial progress has been made in this direction will be evident from a study of this Third Annual Review Number. It contains more creative editorial material than either or both of its predecessors. A quarter century of progress is portrayed—not in general terms, but in quantitative data clearly interpreted. The geographical growth and location of the industries is similarly treated, based on such factors as availability of raw materials, concentration of labor, and distribution of products. The use of power in the chemical industries and the relatively great importance of process steam are interpreted from figures never before correlated. Data on the distribution of chemicals into consuming industries form an exclusive feature of the issue.

IS THERE any doubt of the lively significance of all these things to each and every factor in the chemical engineering industries? Not if they have the intelligent leadership that *Chem. & Met.* takes for granted. The future can be predicated only on the past and it is the future that concerns us. As Mr. Hoover stated in his economic forecast for 1926, "Any business forecast must be simply an appraisal of the forces in motion * * * for and against progress." As far as possible *Chem. & Met.* has arrayed these forces for the guidance not only of those who buy and sell chemical products, but also for the financier and the educator, the executive, the consultant and the maker of equipment—in fact, for all who have an interest in the future of the chemical engineering industries.

Progress in Chemical Engineering

The year 1925 was marked by the erection of new industries on the foundation of scientific research

By H. C. PARMELEE

IN ALL ITS ASPECTS chemical engineering found greater recognition and acceptance in American industry in 1925 than in any previous year. The results fully justified the claims of its advocates. Production was on a more efficient basis, waste was reduced, byproducts were utilized, and research—that modern tool of industry—was applied more intelligently and with an unusual degree of commercial success. Technically trained men migrated from one chemical engineering industry to another, applying fundamental principles to the problems of research and production in a wide range of industries. This phenomenon at once proved the soundness of modern educational methods and emphasized the common interest in chemical engineering in an otherwise unrelated group of industries.

The fruits of research were found in the synthetic production of several basic materials of commerce formerly obtained only from natural sources and by long-established processes. The production of synthetic ammonia, although tardy in its development here in comparison with foreign countries, received an impetus the full effect of which will not be felt until 1926. But the synthetic product practically captured the anhydrous and aqua-ammonia markets and greatly demoralized prices that had been stable for years. Fertilizer ammonia was only indirectly affected by this development due to the increase in the amount of coke oven ammonia available for competition with Chilean nitrate.

Although no synthetic methanol was made in this country in 1925, research and development were initiated that may give substantial domestic production in 1926. The trade influence of the imported product on the domestic wood chemical industry, which was a sensation early in 1925, is discussed elsewhere in this issue by a competent authority.

Synthetic textile fibres known as Rayon had a most striking development during the year, resulting in the erection of a new chemical engineering industry on the foundation of scientific research. Its incidence on the textile industry is a matter of popular knowledge, but its technical importance lies in affording a new outlet for a large quantity of chemical products such as caustic soda, carbon bisulphide, sulphuric, nitric and acetic acids, cotton linters, sulphite pulp and the volatile solvents. American production in 1925 increased 40% over 1924 and 600% over 1920. The estimated 1925 production was 57,000,000 lb., or 30% of the world's output. Prospects for 1926 indicate a domestic production of at least 75,000,000 lb.

Among other notable developments was the widespread use of nitro-cellulose lacquers which predominated over all other finishes in the automobile industry. Here again a new industry called for increased supplies of raw materials and stimulated production of solvents and other chemicals. So popular did these lacquers become following their introduction by the duPont Co. that approximately 70 producers were in operation during 1925.

Two industries in which fundamental research is in progress that will profoundly affect their future development are coal processing and fertilizer manufacture. World wide interest in coal as a raw material for chemical manufacture has been reflected in some measure in this country. The use of water gas as a raw material for methanol and as a source of hydrogen for synthetic ammonia is indicative of the modern trend. No new striking developments were made in coal carbonization but it is understood that considerable progress was made in ironing the kinks out of one promising process. In general there has been a recognition of the fact that a medium-temperature process of carbonization will find greater utility in the United States than low- or high-temperature processes.

In the production of mixed fertilizer there was a trend toward more concentrated types with double the usual percentage of potash, phosphoric acid and ammonia. Looking toward still further concentrated fertilizers there was production on an experimental scale of phosphoric acid by the Liljenroth process and urea by the Lidholm process. The former consists in producing phosphorus in an electric furnace and treating the product with steam in the presence of a catalyst, yielding phosphoric acid and hydrogen. The latter can be used for ammonia synthesis while the former can be combined with ammonia to form ammonium phosphate. The Lidholm process for urea makes use of calcium cyanamid as a raw material.

Reference has been made to chemical engineering education and its role in industrial development. It is fortunate for the harmonious development of this branch of engineering that its educators and industrial representatives have been in close accord. Leaders in both fields have perceived equally the needs of industry and the best methods of meeting them with trained men. The result is a unanimity of opinion on the function of chemical engineering in industry, the mental equipment of the chemical engineer and the character of his work. Such a happy combination of circumstances augurs well for an expanding field of usefulness.

ON the whole, the year 1925 has been a gratifying one in the chemical engineering industries. Chemical prices were on an even keel as shown by the trend of the *Chem. & Met.* index number. There was an upward trend of production and operating efficiency per wage earner due largely to improved technology and mechanization of industry. Foreign trade expanded. And save for those commodities that are the natural monopolies of foreign countries, domestic production left little to be desired in the way of industrial and economic independence. The year 1926 opens with a word of caution from economists against the evils of possible inflation due to speculation. The prosperity that has marked the past year can only be maintained by "tempering our optimism with a sprinkling of caution."

A Quarter of a Century of Growth In Chemical Engineering Industries

Striking commercial development marked by a growing appreciation of the basic economic importance of the group

PROFOUND changes have occurred in the economic and industrial structure of this country during the 25 years that have elapsed since 1900. Paralleling the growth of all manufacture has been a remarkable development in the closely related group of industries that are dependent on the application of chemical technology and the unit processes of chemical engineering. Coincident with this expansion there has come a growing appreciation of the essential relation to all economic and industrial progress. Within the industries there has been a closer cementing together as a result of the increased recognition of their common basis of technology. Many factors have contributed to this. The universities, with a better understanding of the demand for their product, have offered better preparation. The development and more efficient use of chemical engineering equipment has played a part. And, of not the least importance, has been the building of a literature of chemical engineering and a wider exchange of knowledge of process and product.

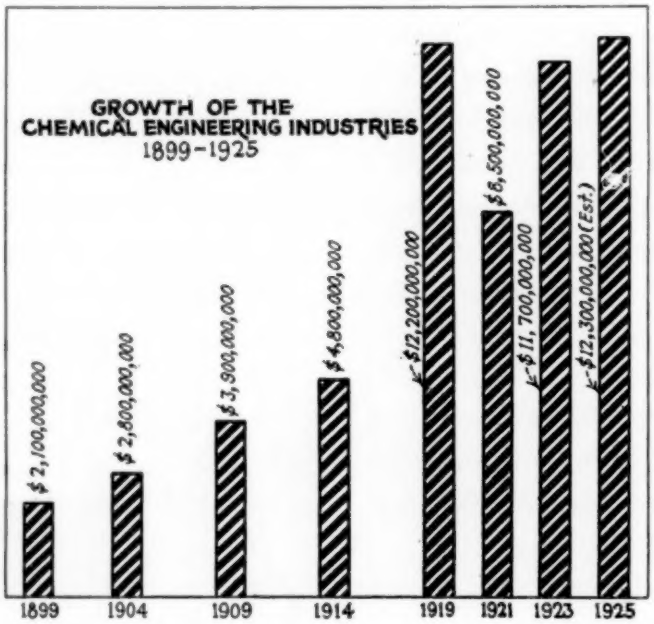
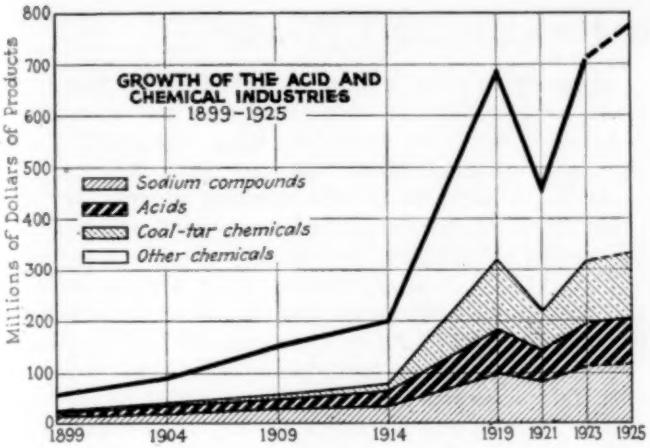
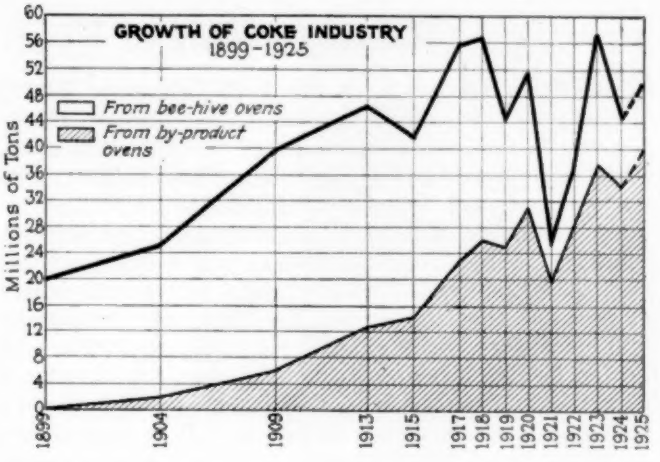


Table I—Basic Data on Chemical Engineering Industries from U. S. Census of Manufactures, 1923.

Industry	Number of Establishments	Capital Invested (1919)	Value of Products Manufactured	Cost of Raw Materials	Wages Paid	Salaries Paid	Number of Wage Earners
Acids, heavy chemicals and coal-tar products	773	$675,089,740	$655,274,829	$328,596,621	$103,300,991	$40,818,616	77,254
Baking powders and yeast (1921)	62	43,486,000	52,885,888	24,666,261	4,479,099	3,185,405	3,557
Bone black, carbon black and lampblack	68	9,790,167	14,599,872	5,294,567	1,460,868	909,604	1,303
Cement	133	271,269,259	264,098,497	100,766,747	49,707,992	11,231,532	35,091
Clay products industries	2,287	422,606,325	447,808,364	136,917,435	170,479,309	29,611,508	139,547
Coke, byproduct and beehive	262	365,249,622	516,922,898	354,030,441	48,107,894	7,823,351	28,364
Condensed and evaporated milk	378	126,952,520	200,111,243	164,746,159	10,641,040	6,067,131	8,723
Corn products	31	58,182,682	116,560,034	74,480,950	9,090,104	2,838,493	6,537
Explosives	106	133,247,684	75,029,127	39,495,972	9,112,027	5,575,426	6,388
Fertilizers	573	311,633,259	183,088,751	127,980,450	16,365,324	9,759,141	18,572
Gas, manufactured	939	1,465,656,265	450,097,161	161,120,082	59,600,334	35,503,600	42,282
Glass	333	215,680,436	309,353,411	113,170,262	89,897,948	15,519,426	73,335
Glue (1921)	47	27,237,000	21,342,004	13,401,858	3,573,149	1,319,549	2,915
Ink, printing and writing (1921)	130	23,506,000	25,849,625	12,706,744	3,016,155	3,203,502	2,180
Iron smelting	169	802,416,541	1,007,613,340	827,629,665	58,935,384	12,276,897	36,712
Leather, tanned and finished	597	671,341,553	488,897,835	321,749,551	73,784,340	15,616,448	59,703
Lime	301	45,844,532	47,243,756	19,700,191	13,522,069	2,537,010	12,290
Matches (1921)	22	29,477,000	30,273,873	13,239,571	4,280,438	1,952,200	4,539
Non-ferrous metal smelting	89	543,341,935	964,168,720	822,688,981	57,370,512	9,491,444	39,104
Oil cloth and linoleum (1921)	29	60,586,645	62,313,601	34,919,048	8,545,069	4,312,403	6,640
Oils, essential	17	6,379,910	3,184,124	2,255,772	237,409	187,533	170
Oils, vegetable (1921)	883	368,886,065	381,531,878	327,867,142	19,256,961	12,478,115	21,772
Paint and varnish	826	239,775,836	404,134,231	248,954,692	29,871,195	28,750,571	22,818
Paper and wood pulp	746	905,794,583	907,346,992	573,727,153	151,476,693	38,086,277	120,677
Petroleum refining	382	1,170,278,189	1,793,700,087	1,425,052,681	103,833,760	27,903,232	66,717
Rosin and turpentine	1,203	33,595,986	35,166,715	8,972,758	15,448,590	1,654,642	34,328
Rubber industries	529	960,070,726	958,517,634	501,162,768	182,084,056	48,963,201	137,868
Salt	75	47,725,231	36,837,162	16,476,623	8,129,492	2,706,317	6,809
Sand-lime brick	31	2,229,769	2,408,106	945,931	697,850	219,533	582
Sugar industries	226	473,242,631	871,736,338	773,663,294	31,875,574	10,751,489	25,645
Soap	270	212,416,866	276,402,838	173,545,981	20,776,443	15,710,759	17,002
Tanning materials and natural dyestuffs	125	38,689,058	35,971,612	24,033,018	3,800,783	2,427,053	3,243
Wall plaster (1921)	144	25,307,000	32,353,697	16,116,801	6,997,050	2,164,290	4,898
Wood chemicals and charcoal	123	42,853,265	29,695,423	17,268,950	4,324,848	1,245,329	4,123
Wool scouring	26	10,049,960	8,190,091	4,528,982	2,025,307	396,183	1,473
Total	12,935	$10,840,884,240	$11,732,249,757	$7,812,874,102	$1,376,106,057	$413,197,210	1,073,161
Total, all manufacturing industries	196,309	$44,466,594,000	$60,555,998,000	$34,705,698,000	$11,009,298,000	$3,014,246,000	8,778,156



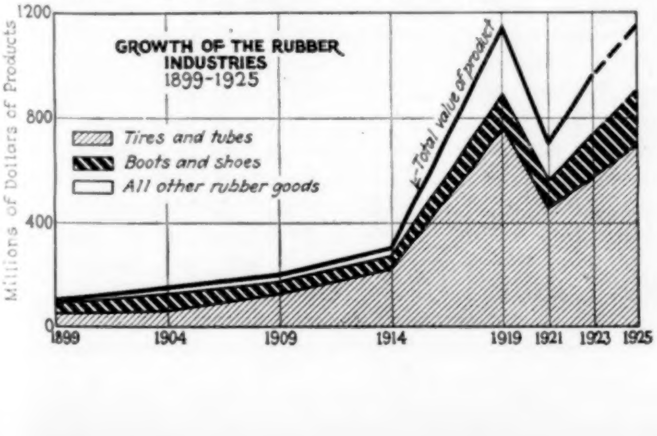


Basic data for the 35 industries selected from the Census classifications for 1923 appear in Table I. There it will be observed that the value of the production of the chemical engineering group amounted to $11,732,-249,757 or 19.3 per cent of the total for all manufacturing industries. This product was produced in 12,935 establishments which, however, comprised but 6.7 per cent of the total for all industries. The greater output per establishment is to be explained not only by the larger scale of operations but also by the relatively greater production per wage earner. Thus the value of product per worker in the chemical engineering industries was $10,930 for 1923 as compared with $6,330 per wage earner for all other manufacturing industries.

Compilation of the total value of products for each census year since 1899, which is shown in Table II and presented graphically in Fig. 1, has its principal value as an indication of the trend rather than as an accurate measure of the rate of growth of this group of industries. The figures are of further worth, however, in emphasizing the effect on the chemical engineering industries of the tremendous inflation of 1919 followed so closely by the disastrous depression of 1921. In the former year, the depreciation of the value of the dollar combined with over-production resulting from war-time capacity to establish records which many industries did not equal until 1925. The third feature of the compilation is the approximately constant ratio existing between the chemical engineering group and the total for all manufactures.

TABLE II—GROWTH OF THE CHEMICAL ENGINEERING INDUSTRIES, 1899-1925

Census Years	Value of Product: Chem. Eng. Ind.	Value of Product: All Manufactures	Per Cent of Total
1899	$2,105,278,610	$11,406,926,701	18.5
1904	2,853,889,346	14,793,902,563	19.2
1909	3,939,565,626	20,672,051,870	19.0
1914	4,803,776,616	24,216,515,000	19.8
1919	12,219,536,700	62,193,427,000	19.7
1921	8,533,839,320	43,653,283,000	19.6
1923	11,732,249,757	60,555,998,000	19.3
1925 (Est'd.)	12,300,000,000	....	....

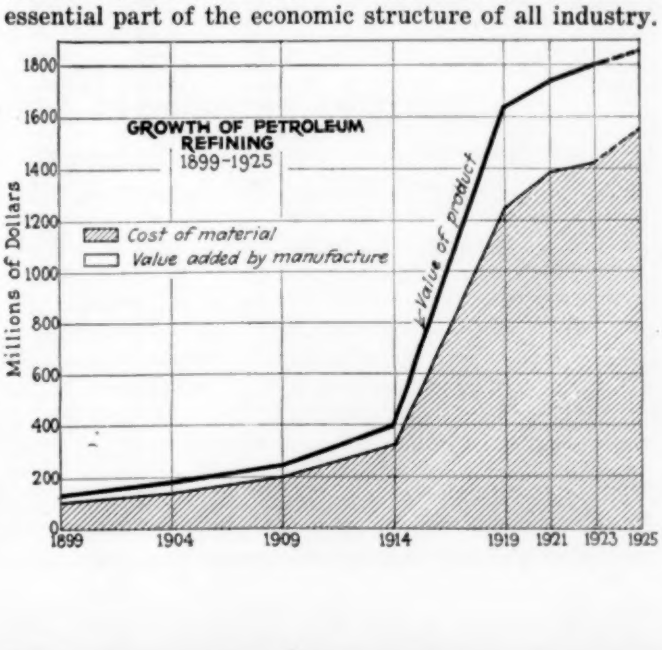


Detailed statistics for certain important industries of the group reveal a number of interesting trends and developments. In the case of the more strictly chemical industries shown in Fig. 2, the year 1914 appears to mark the beginning of an era of expansion. Certain component industries, such as coal-tar chemicals, were produced in only negligible quantities prior to 1914. The acid and alkali industries, on the other hand, were already well established and, therefore, there was relatively less expansion as a result of the conditions brought on by the War and the cessation of international trade.

The passing of the bee-hive oven in the coke industry is the evident trend shown in Fig. 3. Replacement by the more economical byproduct oven has made steady progress with the exception of slight recessions in 1921 and 1924. This incidentally brings out a characteristic of the bee-hive output which has earned for it a reputation as a sensitive barometer of business conditions.

The growth of petroleum refining shown in Fig. 4 gives us the nearest approximation to a smooth curve in its trend since 1900. This industry is one of the very few that has never reported a decrease in the total value of its product despite unfavorable conditions that may exist in general business.

As in the case of petroleum refining, the rubber industry traces its prosperity to the activities of the automobile manufacturer. In fact, this industrial interdependence is but another example of the basic character of the chemical engineering group, which by supplying the raw materials of other manufacturers, becomes an essential part of the economic structure of all industry.



Comparison of Fuel for Process and Power

FIGURES are given in the 1919 Census of Manufacturers, published by the U. S. Bureau of the Census in 1920, showing in detail the consumption of coal, coke, oil and gas as fuels throughout industry and also the primary horsepower installed, the amount of power purchased and the total power consumed for each industry. While these figures are now 6 years old, the fact that 1919 was an exceptionally active year makes it probable that the figures for 1925, when available, will not differ greatly. While the actual quantities may be too low, it is undoubtedly true that, when reduced to ratios and percentages, these figures will hold with fair accuracy for present conditions. In any case, they form the latest available data upon which comparison can be made.

In the accompanying table and charts, these figures have been collected and analyzed for those industries generally considered as chemical engineering industries. In the table will be found the percentage of the total power purchased for each chemical engineering industry, for all chemical engineering industries and for all industry. Another column gives the percentage of the total power requirement that is generated at the plant for each of these categories. The 2 columns at the extreme right show, first, the ratio of fuel used for process heating purposes to that used for generating power at the plant; and second, the ratio of fuel used for process heating purposes to the fuel that would be required if all power used were generated at the plant. In certain industries, such, for instance, as paper and wood pulp, the hydro-electric power generated at the plants has not been considered, for such power requires the use of no fuel in its production.

In order to obtain these figures it is necessary to make certain assumptions. Fuel and power must be reduced to the same basis, i.e., B.t.u. per year. To do this, an average heating value for each fuel must be assumed, a total of yearly working hours for each industry must be found and an overall efficiency of conversion of fuel to electric energy must be selected.

The B.t.u. values of various fuels are assumed as follows: coal, 12,000 B.t.u. per lb.; coke, 11,000 B.t.u. per lb.; oil, 18,500 B.t.u. per lb.; gas, 300 B.t.u. per cu.ft.

Hours of work in each industry can be estimated with fair accuracy from the figures given in the same census for hours of work per week in each industry.

The overall efficiency of the conversion of fuel into electric horsepower hours is taken as 10 per cent. This figure accords with that given by H. G. Stott, *Trans. A. I. E. E., 1906*. Mr. Stott's figure was obtained as the result of a series of careful tests and is 10.3 per cent.

Referring to the table, it will be noted that the chemical engineering industries generate 75 per cent of the power that they use, while all industry generates but 68 per cent of its power needs. Also, these chemical engineering industries use approximately 3 times as much fuel for process heating as for power generation. If the power purchased were to be generated at the plant at the same efficiency as that now generated, then the plants would, on the average, use approximately 2¼ times as much fuel for process heating as would be needed for generation of the full amount of power that they require.

The table also shows how the total fuel requirements of the chemical engineering industries compared to the fuel requirements of all industry. This group of in-

RELATION OF FUEL USED FOR PROCESS TO FUEL USED FOR POWER GENERATION IN THE CHEMICAL ENGINEERING INDUSTRIES

Industry	Coal Used per Year in Tons of 2,000 Lb.	Coke Used per Year in Tons of 2,000 Lb.	Oil Used per Year in Bbls. of 42 Gals.	Gas Used per Year in 1,000 Cu.Ft. Units	Primary Horsepower Installed	Purchased Power in Horsepower	Total Power Consumed	Per Cent of Power Purchased	Per Cent of Power Generated	Ratio of Fuel Used for Process to Fuel Used for Power Generated	Ratio of Fuel Used for Process to Fuel Equivalent of Total Power
Acids, chemicals, tar products	5,331,000	481,000	1,131,000	2,182,000	305,860	170,059	475,919	36	64	3.7	2.4
Baking powder and yeast	222,000	1,000	36,000	3,000	14,360	5,711	20,071	29	71	4.1	2.9
Bone black, carbon black, lamp black	7,000	....	1,000	49,496,000	1,366	491	1,857	27	73	144.0	106.0
Cement	6,304,000	51,000	1,861,000	4,371,000	306,322	182,486	488,808	37	63	2.5	1.6
Clay products	7,669,000	36,000	1,352,000	16,656,000	319,039	115,797	434,836	28	72	3.0	2.2
Coke, byproduct and beehive	25,700,000	561,000	107,000	659,000	150,328	74,551	224,879	33	67	24.0	16.0
Condensed and other milk products	1,453,000	6,000	345,000	234,000	115,072	53,799	168,871	32	68	0.3	0.2
Corn products	972,000	15,000	18,000	24,000	48,451	4,395	52,846	8	92	5.5	5.0
Explosives	481,000	4,000	181,000	65,000	35,149	16,486	51,635	32	68	1.4	0.9
Fertilizers	362,000	1,000	71,000	54,000	46,053	79,886	125,939	63	37	2.9	1.1
Gas, manufactured	1,271,000	162,000	2,880,000	641,000	205,091	33,376	238,467	14	86	0.5	0.4
Glass	2,659,000	132,000	910,000	38,501,000	154,474	52,956	207,430	26	74	4.3	3.2
Glue	336,000	1,000	2,000	5,000	16,286	693	16,979	4	96	3.3	3.1
Inks, printing and writing	34,000	1,000	6,000	20,000	6,464	4,499	10,963	41	59	0.1	0.1
Iron smelting	2,304,000	32,425,000	51,000	1,185,000	1,533,204	48,229	1,581,432	3	97	2.0	1.9
Leather, tanned and finished	1,538,000	4,000	89,000	212,000	159,267	58,971	218,238	27	73	0.6	0.4
Lime	930,000	103,000	27,000	54,000	23,140	28,595	51,735	55	45	6.0	2.7
Matches	51,000	....	6,000	....	9,567	3,380	12,947	26	74	0.8	0.5
Non-ferrous metal smelting	3,607,000	996,000	2,902,000	25,079,000	287,783	171,696	459,479	37	63	1.8	1.1
Oil-cloth and linoleum	238,000	3,000	16,000	....	15,273	12,737	28,010	46	54	4.1	2.2
Oils, essential	14,000	....	4,000	7,000	1,691	142	1,833	8	92	1.8	1.7
Oils, linseed and cottonseed	1,313,000	10,000	394,000	1,529,000	217,150	91,107	308,257	30	70	2.1	1.5
Paint and varnish	534,000	36,000	56,000	261,000	41,559	43,640	85,199	51	49	3.5	1.7
Paper and woodpulp	8,733,000	63,000	2,120,000	287,000	702,178	237,973	940,151	25	75	1.1	0.8
Petroleum refining	4,725,000	320,000	23,717,000	26,919,000	187,521	51,385	238,906	22	78	8.6	6.8
Rubber	2,287,000	5,000	368,000	293,000	235,926	193,961	429,887	45	55	2.2	1.2
Salt	1,039,000	7,000	144,000	45,000	35,345	7,842	43,187	18	82	8.7	7.1
Sand-lime brick	23,000	....	1,000	....	3,818	540	4,358	13	87	1.9	1.6
Sugar	2,473,000	126,000	3,309,000	212,000	271,803	9,993	281,796	4	96	1.0	1.0
Soap	714,000	1,000	97,000	12,000	25,028	8,682	33,710	26	74	3.6	2.7
Tanning materials, natural dyes	344,000	2,000	4,000	149,000	31,603	2,717	34,320	8	92	2.5	2.3
Wall plaster	163,000	5,000	111,000	11,000	13,993	18,363	32,356	57	43	3.4	1.5
Wood chemicals	350,000	....	67,000	1,798,000	13,655	2,283	15,938	14	86	5.7	4.9
Wool scouring	57,000	....	8,000	....	6,740	3,050	9,790	31	69	3.1	2.2
Totals—											
Chemical engineering industries	84,238,000	35,558,000	42,392,000	170,964,000	5,540,559	1,880,391	7,420,950	25	75	2.9	2.3
All industries	217,798,024	42,595,019	92,029,692	341,921,022	20,062,636	9,442,156	29,504,792	32	68	.....	.....
Per cent in chem. eng. industries	39	84	46	50	28	20	25	..	..	.....	.....

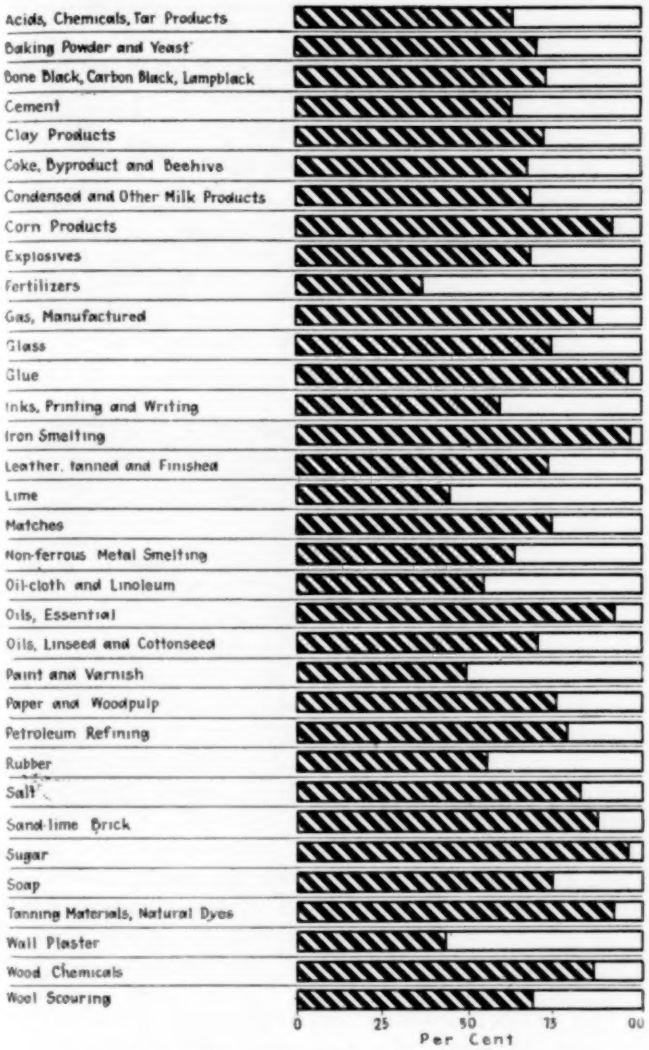


Fig. 1—Relation of Power Generated at the Plant to Purchased Power

The black portion of each bar shows the percentage of the total power requirement generated at the plant, while the white portion shows the percentage purchased.

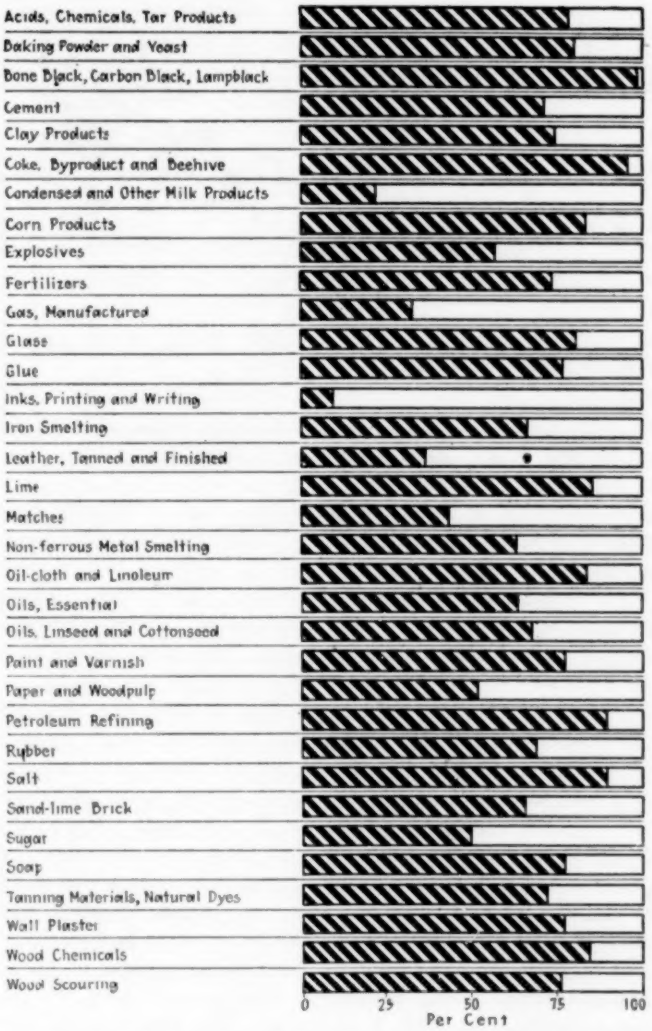


Fig. 2—Relation of Fuel Used for Process Heating to that Used for Power Generation

The black portion of each bar shows the percentage of the total fuel consumed that is used for process heating, while the white portion shows the percentage used for power generation.

dustries forms about ⅕ of all U. S. industry. It uses 39 per cent of the coal, 84 per cent of the coke, 46 per cent of the oil, and 50 per cent of the gas used for fuel purposes by all industry.

These chemical engineering industries have 28 per cent of the installed primary horsepower of all industry, purchase 20 per cent of the power purchased by industry and consume ¼ of all the power used by industry from all sources. It is clear from these figures that the chemical engineering industries occupy a position of great importance in the field of fuel and power consumption.

National Localization of Chemical Industries

IN THE localization of chemical industries we have an excellent example of economic forces that tend to reach a condition of equilibrium. The principal component forces are—(1) markets, (2) raw material sources, (3) labor sources, (4) fuel and power sources, and (5) transportation facilities; and stable equilibrium is reached only when the greatest possible differential between cost and selling price obtains. In a well-developed country such as the United States, in which there is great latitude geographically, it is possible to illustrate to advantage the above forces governing localization. For this purpose, a few of the most important industries have been studied, using as a statistical basis the 1923 United States Census of Manufactures.

Density of population is, of course, a basic index of consuming power, and hence of industrial localization; and other conditions being favorable, we may expect to find the industries following the people, geographically speaking. However, it may be more rational for an industry to disregard large centers of population, and instead, to seek cheap raw material, labor, fuel and power. And lastly, transportation costs may be such an important tactor that it transcends all others. As a practical test of the foregoing hypothesis let us examine several industries in the chemical engineering group.

Fig. 2 shows the localization of the sulphuric acid and fertilizer industries. As these industries are in a measure complementary—superphosphate plants being

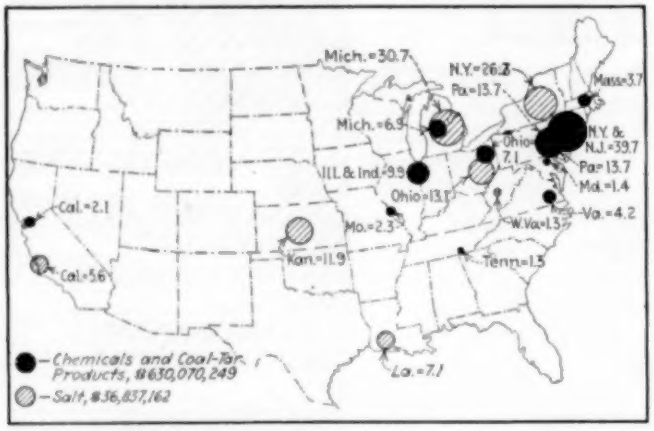


Fig. 1—Chemicals and Coal-Tar Products, and Salt

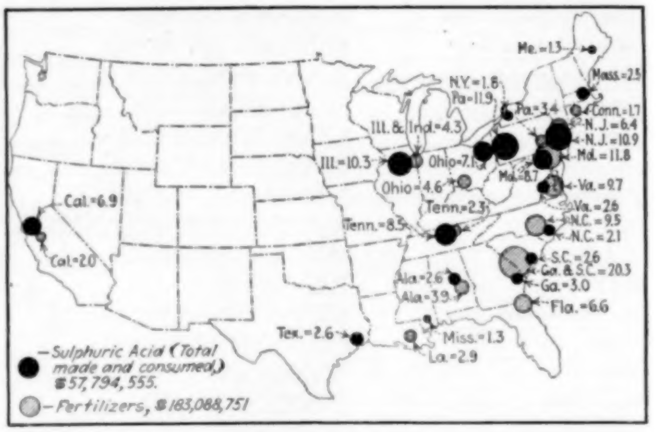


Fig. 2—Sulphuric Acid and Fertilizers

the outlet of at least 30 per cent of all sulphuric acid made—we should expect them to be related geographically. Transportation costs are a limiting factor with both sulphuric acid and fertilizer, and hence there should be an equitable distribution of capacity among the principal consuming centers. The map shows this to be true.

By way of contrast, note Fig. 3 and the definite centralization of the petroleum refining and rubber industries. Crude oil can be piped cheaply to advantageous seaboard locations, from which wide distribution of the refined products is effected. Here the balance is between markets and raw material sources, with transportation playing a big part. But carrying costs are proportionately less, as compared with sulphuric acid and fertilizers, and hence it is not surprising to find 63.3 per cent of the refining done in three centers: Southern California, Texas Gulf and on the East Coast near New York City. The rubber industry shows even greater concentration in a few centers, 65.0 per cent being in two regions, northeastern Ohio and central New England. The raw materials of manufacture, crude rubber, compounding materials, fillers, and accelerators have a high bulk value, consequently it is not essential to be near raw material sources. But skilled labor is necessary, and the rubber group is an excellent example of the migration of industrial workers to large, highly-specialized centers.

Salt manufacture, Fig. 1, is a striking example of localization according to raw material sources, about 70 per cent of the industry being in three centers of natural brines, Michigan, New York and Ohio. Fortunately, these natural sources of salt are near large centers of population and are so distributed that transportation costs are minimized. More than half of the chemical and coal-tar industry is localized in three states, New York, New Jersey and Pennsylvania, but in contrast to the salt industry, raw material sources are relatively unimportant. For example, about 30 per cent of soda ash is used in glass manufacture, 25 per cent of caustic soda is consumed by the soap industry, 30 per cent of ammonia is used in making fertilizers, and 25 per cent of aniline oil is used by the rubber industry. Transportation costs on heavy chemicals are such that profits are quickly absorbed, hence relatively small producing centers can compete successfully in their respective territories with the large East Coast group. Hence the localization of the chemical industries proper is determined largely by other types of manufacturing industries that are the immediate consumers.

The leather tanning industry, Fig. 4, established initially to serve the shoe and other consumers of leather in the Northeast, has tended to expand westward. Markets and sources of raw material seem to have about equal weight, and both are fairly well distributed, so that a decentralized industry is logical. In the manufacture of paper and pulp, proximity to source of raw materials, power and water supply are necessary determining factors, and markets have an influence as well. Thus we find nearly 50 per cent of the industry concentrated in New England and New York states, with other important centers in Pennsylvania, Michigan and Wisconsin. Of late, the trend is toward longer transport of raw material, with primary regard to power sources.

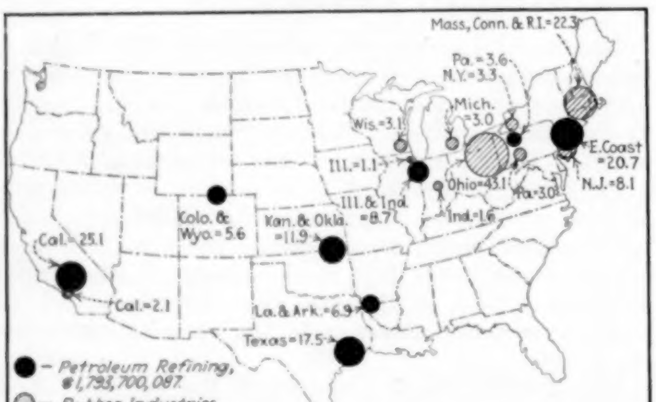


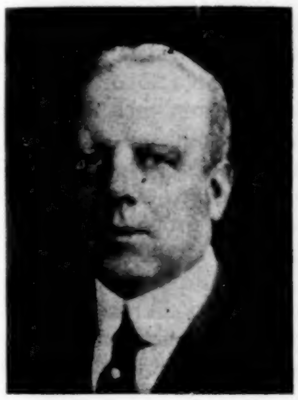
Fig. 3—Petroleum Refining and Rubber Industries

Fig. 4—Leather, and Paper and Wood Pulp

Fertilizer Materials Bulk Large in the World Chemical Markets

Nitrogen, potassium and phosphorus, the triumvirate of the commercial fertilizer industry, each presents its individual marketing problems

By Charles H. MacDowell
Armour Fertilizer Works, Chicago, Ill.



THROUGH his connection with Armour & Co. since 1887 and his organization of the Fertilizer Dept. of that company in 1894, Mr. McDowell has long been a leading figure in the fertilizer industry. He has been twice president of the National Fertilizer Assn.

During the war he was on the Chemicals Committee of the Council of National Defense and was director of the Chemicals Division of the War Industries Board. After the Armistice he was associate economic advisor to the American Commission to Negotiate Peace and assisted in formulating the chemical clauses in the treaty.

He has been honored at home and abroad with numerous decorations and in 1921 received the honorary degree of Sc.D. from the University of Pittsburgh.

FERTILIZER materials are important items in internal trade. The world movement of potash salts, phosphate rock, sulphur, pyrite and sodium nitrate bulks large in freight statistics. To these we must add by-product coke and gas-plant sulphate of ammonia, and the increasingly important ammonia compounds manufactured synthetically on a huge scale in Germany, and in a mild way in other countries. Fixed nitrogen is a key product for either the maintenance or the destruction of civilization.

Prior to 1914 the chief sources of nitrogen were nitrate of soda, coke-oven and gas-plant sulphate of ammonia, cyanamid and organic ammoniates from vegetable and animal sources. Costs were relatively high and the liberal use of these products was greatly restricted. In 1913 the amount of synthetic nitrogen produced was comparatively small and the methods used were expensive and attended with considerable risk. Through necessity Germany made rapid strides towards perfecting its synthetic process during the war, and today has an annual capacity of about 450,000 tons of synthetically fixed nitrogen.

Nitrogen Sources and Products

The first in importance of the different forms of nitrogen now being produced is synthetic sulphate of ammonia made by the Haber-Bosch system. This product is a dry, neutral, white crystalline salt analyzing 25½ per cent of ammonia, in good mechanical condition, and has established a standard of quality for coke-oven production.

Next in importance is the coke and gas plant product, which is generally a light gray color, and as originally produced was slightly acid. Coke ovens are now gradually changing their production to a neutral product, to meet the competition of the synthetic.

Third in importance is nitrogen made by the cyanamid process. This is a dark powder testing from 23 per cent to 28 per cent ammonia. Due to its alkalinity and powder form there have been difficulties to overcome in its use. Its caustic nature tends to irritate the skin; also, the amount which can be used in a fertilizer mixture is limited on account of alkaline content. When used properly it is a valuable fertilizer material.

Ammonium nitrate is a white, crystalline salt testing about 42 per cent ammonia. It is hygroscopic in nature, and not well adapted for fertilizer use.

Ammonium sulphate saltpeter (Leunasalpeter) is a double salt of neutral ammonium sulphate and ammonium nitrate. Because of its nitrate content it has a quick action corresponding to that of nitrate of soda. It is inclined to be hygroscopic and lumpy, although less so than ammonium nitrate. Its use in the semi-tropics has so far not been satisfactory because of its water absorption tendency. In this country, especially at interior points, it seems to work well in mixtures. It analyzes about 31½ per cent equivalent ammonia.

Urea is a compound containing about 55 per cent of ammonia. It can be made from cyanamid and also from ammonia and carbon dioxide. Urea is not suitable for mixing with soluble phosphoric acid compound, as it produces a gummy mass which cannot be distributed. It can be mixed with the non-soluble forms of phosphoric acid. Urea seems to be a desirable form of nitrogen for top dressing meadow lands, as it is nontoxic to stock. While its comparative fertilizer value is not yet fully established, field tests on different soil types in which urea was used would indicate no superiority over sulphate of ammonia.

Calcium nitrate is produced in Norway and Sweden by the arc process. Weak nitric acid is neutralized with calcium carbonate. The product, containing about 15 per cent nitrogen, is decidedly hygroscopic. It cannot be mixed with other materials, and is used for direct application. It is generally shipped in air-tight drums.

The Deutsche Stickstoff Syndikat is now marketing from the Merseburg plant calcium nitrate in which the nitric acid is obtained by oxidizing ammonia. This is combined with pure carbonate of lime obtained as a sub-product in the making of ammonium sulphate, where calcium sulphate is used as a raw material. Calcium nitrate so made is said to be less hygroscopic, and can be shipped in specially treated bags.

Nitrogen Consumption and Prices

Of the world's production of nitrogen compounds, agriculture consumes about 89 per cent and chemicals and explosives about 11 per cent. The principal chemical uses are in the manufacture of sulphuric acid, nitric acid and anhydrous ammonia.

The average quoted prices for sulphate of ammonia in the United States for the past thirteen years, as compiled by the Barrett Co. of New York, is as follows:

Year	Price per Ton (2,000 Lb.)	Year	Price per Ton (2,000 Lb.)
1913	$62.86	1920	$86.22
1914	54.20	1921	50.50
1915	66.17	1922	55.00
1916	76.56	1923	61.60
1917	94.60	1924	52.00
1918	98.60	1925	50.00
1919	77.60		

From 1917 on, the prices are f.o.b. producers' works.

In this country sulphate of ammonia is sold by the producer either directly or through agents. In England the distribution is controlled by the British Sulphate of Ammonia Federation. In Germany the Deutsche Stickstoff Syndikat G.m.b.H. control the distribution of 95 per cent of all nitrogen products.

The last figures available on the world's production of nitrogen in tons of 2,240 pounds of pure nitrogen, for the year ending May 31, 1925, are as follows:

	1924/25	
By-product sulphate of ammonia	290,300	
Synthetic sulphate of ammonia	254,800	
		545,100
Cyanamid	115,000	
Nitrate of lime	25,000	
Other forms of synthetic nitrogen	60,000	
		200,000
Total production		745,100
Deliveries of Chilean nitrate of soda in consuming markets		363,000
		1,108,100
Estimated total for agricultural consumption		983,100

Production from World Viewpoint

A considerable proportion of the world's production of nitrogen centers in two synthetic plants in Germany —the largest at Merseburg, with 300,000 metric tons fixed nitrogen; the other at Oppau, with 100,000 metric tons fixed nitrogen. Germany in addition is producing about 50,000 tons fixed nitrogen in calcium cyanamid and 75,000 tons as by-product of the coke and gas plants. This gives Germany a capacity of 525,000 tons of fixed nitrogen annually.

Chile ranks second in importance, with a producing capacity of 465,000 long tons of nitrogen and a present output of 365,000 long tons, in the form of nitrate of soda.

The United States is third in point of production. The figures for 1925 are estimated at about 118,000 metric tons of pure nitrogen, exclusive of organic forms. Of this production 105,000 tons is from gas and coke ovens; the balance is synthetic nitrogen, produced at present at five plants located at Syracuse and Niagara Falls, New York, and at Seattle, Wash. There is also under construction a plant using the Claude system, at Charleston, W. Va., which will have a daily capacity of about twenty-two tons. This synthetic product is sold as anhydrous and aqua ammonia.

England comes fourth with a production of about 95,000 metric tons of nitrogen. Of this about 10,000 tons is in the form of synthetic production; the balance is from gas and coke ovens. Plans are on the way in England for increasing synthetic process to a daily capacity of about 800 tons.

Norway comes next with a production capacity of about 35,000 tons.

Production in France amounts to about 20,000 metric tons nitrogen; Japan, about the same as France. Other producing centers in a small way are Belgium, Holland, Italy, Spain, Denmark, Sweden and Australia.

Present and Future Markets

When present enlargement plans are completed on the two large synthetic nitrogen plants at Merseburg and Oppau, Germany, it will be impossible to increase the production in Germany without building new units, and it is not likely that new capital will be available for this purpose under present conditions. Germany has an export surplus equivalent to about 750,000 tons of sulphate of ammonia; England, 250,000 tons; United States, about 125,000 tons. The export field for European surplus is largely in Spain, Holland, Belgium, Denmark, China, Japan, the East Indies, and a relatively small amount to the West Indies. The division of European export business is fairly well apportioned between Germany and England, but there seems to be an open field for the Oriental trade. A small tonnage from Germany has been marketed in the United States. Several officials of the Stickstoff Syndikat have recently been in the States to inaugurate intensive propaganda. Before the war Germany imported about 700,000 tons of nitrate of soda. Germany's plans for expansion now hinge on increased consumption and her ability to replace nitrate of soda with fixed nitrogen products. It is claimed that Germany's fixed nitrogen can be produced cheaper than Chilean nitrate, but the prosperity of Chile is so interwoven with her nitrate exports that it does not appear probable that Chile will give up her nitrate fields without a bitter struggle. There is a Chilean export duty of $12.00 per ton on nitrate, which can be reduced in case of necessity, and plans are now under way for further reduction of production costs by improved methods of recovery.

Marketing Nitrate of Soda

Nitrate of soda is a crystalline salt, the usual commercial product (about 95 per cent sodium nitrate) containing approximately 15½ per cent nitrogen. It occurs in the mineral caliche, of which it is the chief valuable ingredient. Caliche is found in a narrow valley in the northern part of Chile, between the low coastal range and the Andes. The nitrate is extracted from the caliche by leaching with water and evaporating the solution thus obtained. The process is comparatively inexpensive.

Nitrate of soda has been the chief raw material for supplying the nitrogen in the manufacture of munitions. Nitric acid made from it tests 60 per cent to 66 per cent as compared to 50 per cent to 55 per cent from oxidized ammonia, making the latter more expensive to concentrate. Its manufacture from nitrate of soda has been standardized.

While synthetic nitrogen compounds have replaced nitrate of soda in Germany this is largely due to economic conditions. The Germans have recognized the value of nitrate of soda and are now making a double salt, composed of about three parts sulphate of ammonia and one part nitrate of ammonia, as a substitute.

There are three grades of nitrate of soda, the principal one being the 95 per cent, which is used for agricultural purposes. The second in importance is the 96 per cent, for chemical uses. The third, which is extremely limited, is nitrate of potash or nitrate of soda-potash testing between 12 per cent and 40 per cent potash (K_2O) and about 14½ per cent nitrogen.

The nitrate deposits were discovered in 1809 but were not prepared for commercial use until 1825, since which time more than 67,000,000 tons have been exported. The yearly consumption since 1908 has varied between 2,000,000 and 3,000,000 tons per year, the maximum consumption being reached during the years 1916 to 1918 inclusive, when nitrate played such an important part in war operations. In 1913 the amount of nitrate of soda consumed in the United States was 625,000 tons. In 1918 the maximum consumption was reached, when 1,845,000 tons were imported. At the present time about a million tons is consumed annually, about 65 per cent of which is for agricultural purposes and 35 per cent for explosives and chemical use.

The Chilean operators have formed an association, fixing prices in May for the twelve months period ending in June. This association has operated successfully since 1920, and in spite of over-production has been able to keep its members in line.

The sale of nitrate in the United States is handled through five importers, four of whom have offices in New York and one in Wilmington, Delaware. Two of the importers are owners of officinas in Chile, but are not members of the Association. One importer is a large manufacturer of explosives. Two of the New York importers have large merchandising interests in South America and own or control steamer lines. Two of the importers represent London firms.

Nitrate is sold in lots according to buyer's requirements, for deliveries at ports during the year. The price at which it is sold in the United States yields a very small percentage of profit over actual cost. Prior to 1914 some of the large consumers imported their own material, but under present conditions this is not profitable. The domestic prices for nitrate over the past ten years have ranged between $2 and $4.42 per hundred pounds ex vessel. During the present season the prices have ranged between $2.40 and $2.65 per hundred pounds. The U. S. Department of Commerce has investigated Chilean nitrate costs, and believe that if necessary they could be reduced by a little over $12 per ton and still leave the owners an ordinary profit.

Marketing Potash

Potash, a necessity in agricultural and chemical industries has been developed so that the world's needs for centuries are assured. Prior to 1914 Germany controlled the only commercially worked deposits but since then France has obtained the important Alsatian deposits, Spain has started development of deposits at Suria, and the United States has made progress toward development of her own resources.

The value of potash for agricultural uses was discovered by Von Liebig about 1860; the first works were established in Stassfurt, Germany, about 1861. The industry has grown, until today Germany has over 200 developed works, Alsace 18, and Spain has 13 in process of development. Consumption has not kept pace with productive capacity, and at the present time about 75 German and 17 French mines are operating.

The principal potash salts for agricultural purposes, and the basis on which they are sold, are as follows:

	Grade (in Per Cent)	Sold on Basis (in Per Cent)	Form
Muriate of potash	80–85	80 KCl	Potassium Chloride
Sulphate of potash	90–95	90 K_2SO_4	Potassium Sulphate
Double manure salt	48–53	48 K_2SO_4	Potassium Sulphate
Manure salt	30	30 K_2O	Potassium Chloride
Manure salt	20	20 K_2O	Potassium Chloride
Kainit	12.4	....	Potassium Chloride

For the manufacture of fertilizers, potash must be in water-soluble form. The only other Government specification limits the amount of borax in fertilizer material to one-half of one per cent. Sulphate of potash for tobacco fertilization should not contain more than three per cent chlorine.

About 90 per cent of the potash produced or imported into the United States is used for agricultural purposes; the balance for chemical uses.

The production of potash for 1925 is estimated to have been:

Germany	1,300,000 tons pure potash (K_2O)
Alsace	300,000 tons pure potash (K_2O)
United States	24,000 tons pure potash (K_2O)

Consumption of Potash

Germany leads in point of consumption, with 825,000 short tons K_2O. United States next, with 300,000 tons; France 120,000; Holland 100,000; Great Britain 50,000; Sweden 35,000; Denmark 25,000; other European countries 70,000; other foreign countries 100,000. The heaviest United States consumption is in the eastern and southern coastal plain sections, with an increasing demand in the central areas. It is used largely under cotton, fruits, tobacco, truck and root crops, and on peaty or muck lands it gives unusual results. Consumption of potash in this country in 1925 will exceed the pre-war figure for the first time. The amount of potash consumed per acre in the United States compared with Holland, Germany and Belgium is small, and foreign producers are looking to the United States as their best field for increased consumption.

Marketing Arrangements for Foreign Potash

Sales of foreign potash in the United States are handled through New York sales organizations. Actual sales, however, are made through brokers. Aggressive propaganda work is conducted through the New York offices. The two largest American producers maintain selling organizations in New York and Baltimore.

Prior to 1914 the Germans controlled the world's supply of potash, and prices were fixed through a syndicate, in the early part of each year, for the entire season. In 1910 German producers formed a Syndicate under State control, and participating tonnage was allocated to different mines through a Government agency. After France had acquired possession of the Alsatian deposits there was open competition for the first time, which resulted in lower than pre-war prices. In 1924 the German and French Syndicates came to agreement on export trade, and divided the market on a basis of about 67½ per cent to the Germans and 32½ per cent to the French. In May, 1925, a new agreement was reached, whereby the Germans were given 70 per cent and the French 30 per cent. Late in 1926 Spanish product will be available for export. Whether it will be taken into the German-French selling arrangement remains to be seen.

The possibility of American production no doubt influences the foreign prices of potash. We produce less than one-tenth of our annual consumption, but the possibilities of expansion—especially in the Searles Lake district in California—doubtless has a restraining influence on present potash prices. The crying need in Germany and France is a wider consuming market, and the policy of the foreign syndicates seems to tend toward reasonable prices to encourage increased consumption. Prices of potash over a period of years, exclusive of

war years, have been maintained on a fairly uniform basis and have not varied as much as on other raw materials. Kainit has ranged between \$5.50 and \$9 per ton; 20 per cent manure salts from \$7.50 to \$12 per ton; muriate from \$30 to \$36 per ton, basis 80 per cent; sulphate from \$40 to \$46 per ton, basis 90 per cent. During the war domestic potash sold at from \$4 to \$5 per unit K_2O, German muriate as high as \$500 per ton, and sulphate at \$400 per ton. Present prices, bulk basis, c.i.f. Atlantic and Gulf ports, are as follows:

	Per Ton
Muriate, basis 80 per cent	\$33.65
Sulphate, basis 90 per cent	44.60
30 per cent manure salts, basis 30 per cent	18.00
20 per cent manure salts (no charge for over-run)	11.35
14 per cent kainit (no charge for over-run)	8.50
12.4 per cent kainit (no charge for over-run)	8.00

For bagged material \$1.30 per ton is added for muriate, \$1.25 for sulphate, and \$2 per ton for other grades. From the above list prices discounts are given varying from one to ten per cent, according to the tonnage ordered. Further discounts of from two and one-half to six per cent are allowed on summer deliveries. There is no tariff on potash. At the close of the war effort was made by some American producers to fix a duty, but nothing was accomplished. Free entry of fertilizer raw materials is a pretty generally accepted world policy.

Potash salts produced in the United States, by years, from 1915 to 1925 inclusive, in short tons of K_2O, are as follows:

1915	1,000	1921	10,171
1916	9,720	1922	11,714
1917	32,573	1923	20,215
1918	54,803	1924	22,896
1919	32,474	1925—about	24,000
1920	48,077		

About 20,000 tons per year is produced by the American Trona Corporation at Searles Lake. They have been able to meet the foreign competition. This has been possible through the marketing of important by-products. The U. S. Industrial Chemical Co. is the next largest producer in the United States. Their production this year will probably amount to 3,000 tons pure potash. Other producers are cement plants and blast furnaces, and the sugar companies using the Steffens process. There were 128 potash producing plants in operation during the war, of which only three or four have survived. Some of the promising fields for future operation are the alunite beds of Utah, the leucite deposits of Wyoming, the Texas potash deposits, and the New Jersey greensands. Nebraska brine lakes played an important part during the war. Their only hope of future operation lies in recovering soda ash and other by-products, and obtaining a cheap fuel supply.

The German-French combination is the one outstanding case of foreign monopoly where the sales price has been kept on a reasonable basis.

Marketing Phosphoric Acid

Compounds containing phosphoric acid, nitrogen and potassium, are the commercial plant food materials used by the commercial fertilizer industry. The chief sources of supply of phosphoric acid are raw rock, treated with sulphuric acid, and basic slag from blast furnaces. The electric furnace method of treating phosphate rock at Anniston, Alabama, is proving successful in making phosphoric acid for chemical purposes, but present costs are too high for making fertilizer forms.

The largest percentage of phosphoric acid is used for fertilizer. Next in importance comes baking powder. Other uses are for water-softening, weighting silk, clarifying sugar, metal treating to prevent rust, fireproofing, soft drinks, yeast and match manufacture.

As phosphate rock is the principal source of supply for phosphoric acid, a brief statement is here given of the world's production in 1925:

United States	3,000,000 long tons
Africa	4,000,000 long tons
Pacific and Indian Ocean	900,000 long tons
Curacoa	90,000 long tons
Europe	110,000 long tons
Total	8,100,000 long tons

In the United States, Florida is the principal producing state, with 2,500,000 tons. Tennessee will produce this year about 450,000 tons, and the Western states 40,000 tons. The capacity of the Tennessee and Florida plants is about double the present consumption. This condition has brought about low and unprofitable prices. Of the Florida rock produced this year about 850,000 tons will be exported, principally to Germany and the Netherlands. The prices for export rock are unsatisfactory, due to foreign competition.

The prices on Florida rock vary with the analysis, from \$2.65 for 68 per cent rock to \$5.75 for 76 per cent rock f.o.b. mines, per ton of 2,240 pounds. The prices for Tennessee rock vary from \$4.50 for the 72 per cent grade to \$5 for the 75 per cent grade f.o.b. mines, per ton of 2,240 pounds. The rock mined in Idaho is used largely in the manufacture of double superphosphate at Butte, Montana, and in California for making acid phosphate.

The demand for higher analysis brands has stimulated the production of high grade rock in Florida and has resulted in materially better prices. Florida operating conditions are not satisfactory, as fuel and labor are high. Movement of Florida rock has also been hampered by railroad congestion.

European countries are consuming basic slag about as follows:

France	1,200,000 tons
Germany	1,000,000 tons
England	300,000 tons

Fertilizer manufacturers this year will produce about 3,500,000 tons of acid phosphate. In addition to the regular fertilizer acid phosphate testing from 16-20 per cent of P_2O_5, there is a limited quantity of double superphosphate testing from 40-45 per cent being made at Butte, Montana, Charleston, S. C., Baltimore, Maryland, and Tampa, Florida. Present annual production of double superphosphate is between 50,000 and 60,000 tons.

Florida and Tennessee reserves of phosphate rock should take care of the United States' requirements for a hundred years.

A survey of undeveloped deposits by the United States Geological Survey indicates a total of about 6,000,000,000 tons.

Developments in foreign fields are progressing satisfactorily. Morocco conditions are especially favorable, as labor costs are low and European markets can be reached at low freight rates. Moroccan reserves are estimated to contain in excess of 15,000,000,000 tons.

Sulphur Market Characterized By Steady Demand

Use by two industries of major part of domestic consumption makes for stable conditions

By Raymond F. Bacon
Texas Gulf Sulphur Co., New York City

Bachrach

FOR nearly ten years director of the Mellon Institute of Industrial Research, Dr. Bacon had an exceptional opportunity to familiarize himself with American industry and promote the application of chemical engineering to its problems.

During the war he served as a Colonel in the Chemical Warfare Service and had charge of the chemical work of our Army in France. He holds several college degrees, and has been decorated by home and foreign governments.

SULPHUR as a raw material for chemical and allied industries is sold chiefly as "crude" sulphur. Mechanically ground sulphur, known as "flour," sublimed sulphur or flowers of sulphur, and even chemically precipitated sulphur find specialized uses and quotation on the market. The tonnage of these goods is relatively small, and may be looked upon as a derivative of crude sulphur. Before the development of the hot water process of mining, the sulphur of commerce very often contained earthy impurities, was not particularly uniform in color or composition, and the term "crude" was properly descriptive. Improved methods of extracting sulphur from the ore in other countries, and especially the hot water process of recovery practiced in this country, yield a very uniform and pure material. It is this quality of sulphur that we today must consider as the crude sulphur of commerce although it is pure enough for most uses.

While the consumption of sulphur naturally follows the trend of economic and industrial conditions, it is vital to the production of so many absolute necessities that a fairly stable market exists at all times. In five of the eight years, 1918 to 1925, inclusive, the domestic consumption has varied between 1,040,000 and 1,150,000 tons, and these figures probably represent the normal requirements. The present large consumption is the result of two major influences. The first of these is normal expansion. Measured in terms of total sulphur, whether supplied as pyrites, smelter gas acid, or brimstone, the growth for the past 20 years has been at the rate of about 50,000 tons per year. The second and more potent of the two, as accounting for the tremendous increase of the past ten years is that of the adoption of elemental sulphur in place of other raw materials within consuming industries. Prior to the war 1,300,000 tons of pyrites, equivalent to 600,000 tons of sulphur, were used to make sulphuric acid. At present less than 500,000 tons of pyrites are so used, and the difference is reflected in elemental sulphur consumption.

The two major sulphur consuming industries are sulphuric acid manufacture, requiring almost 800,000 tons per year, and the sulphite pulp industry, which consumes 200,000 tons. The general relation of sulphur to the industries using sulphuric acid can be seen from the following distribution of all acid. About two-thirds of this total is made from elemental sulphur, one-sixth from pyrites, and one-sixth from smelter gases. Simply to apportion two-thirds of these various consumptions to sulphur is not entirely correct, for with some it is a case of all the acid coming from sulphur, in others, the great bulk will have been of smelter gas or pyrite origin. Without attempting this finer segregation, the distribution of the total of 6,000,000 tons for 1924 as estimated by *Chemical and Metallurgical Engineering* in its Second Annual Review Number (January, 1925), was as follows:

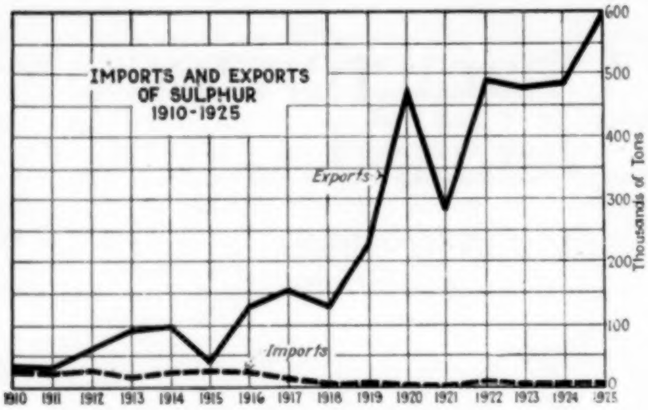
Fertilizers	1,800,000
Oil refining	1,300,000
Chemicals	1,000,000
Steel pickling	600,000
Metallurgical and storage batteries	600,000
Paints and textiles	300,000
Explosives	180,000
Miscellaneous	400,000
Total	6,180,000

It will be noted that most of these uses for acid are in industries whose operation is continuous. An accelerated production of acid phosphate takes place during the winter in anticipation of the spring fertilizer distribution. Northern paper mills often will receive their entire winter's requirements of sulphur in the late fall. This buying, together with the heavier demands for acid phosphate manufacture, make the late fall and early winter shipments larger than at other seasons of the year.

Sulphur is handled almost entirely in bulk, whether the shipment is made by rail or vessel. Consumption takes place in a relatively small number of plants, each with large requirements, and the standard unloading equipment for loose bulk material is well suited to the handling of sulphur. A carload is the minimum shipment, and depending on the size of the plant, will vary up to an entire steamer load of several thousand tons.

Values and quotations of sulphur are all based on the long ton of 2,240 lb. Differences naturally exist between New York, Texas, and Pacific Coast quotations. For uniformity the trade quotations at the mines have been supplied in the table.

Before America became self supporting as regards its production of sulphur, prices, while uniformly high, were susceptible of wide fluctuation. The American industry established itself on an $18.00 per ton basis, and was so conducted until the war demands came on.



The Government fixed price of $22.00 per ton quickly yielded to the changed conditions brought about by the Armistice, and the $14.00 which has prevailed since 1921 up to the current year is without precedent in all sulphur marketing.

	Domestic Sulphur Consumed	Valves per Ton
1910	220,177	$18.00
1911	225,692	18.00
1912	247,554	18.00
1913	230,112	18.00
1914	243,722	18.00
1915	256,732	19.00
1916	638,080	20.00
1917	967,642	22.00
1918	1,135,617	22.00
1919	453,545	18.00
1920	1,040,175	16.00
1921	668,671	14.00
1922	857,960	14.00
1923	1,146,315	14.00
1924	1,054,539	14.00
1925	1,150,000*	15.00

*Estimated.

Since the closing of the original mine of the Union Sulphur Co. in western Louisiana one year ago the activities of all three producers have been confined to a relatively small area in Texas. The new exploitation by the Union Co., the operations at the Bryan and Hoskins Mounds by the Freeport Sulphur Co., and those of the Texas Gulf Sulphur Co. at Big Hill are within a triangle, the legs of which are not over 50 miles long. The area may be described as situated south and west of Houston and bordering on the Gulf of Mexico. As heretofore, water shipments have been loaded at the ports of Sabine, Galveston, and Freeport, all within the State of Texas.

The production, domestic shipments, imports and exports of sulphur since 1910 are shown in the following table:

	U.S. Production	U.S. Consumption	Exports	Imports
1910	247,060	248,833	30,742	28,656
1911	205,066	249,892	28,103	24,200
1912	786,735	274,339	57,736	26,885
1913	491,080	244,748	89,221	14,636
1914	417,690	266,532	98,163	22,810
1915	520,582	271,379	37,271	24,647
1916	649,683	659,590	128,755	21,510
1917	1,134,412	968,615	152,736	973
1918	1,353,525	1,135,672	131,092	55
1919	1,190,575	453,622	224,712	77
1920	1,255,249	1,040,219	477,450	44
1921	1,879,150	668,675	285,762	4
1922	1,830,942	865,920	485,664	7,960
1923	2,036,097	1,146,780	472,525	465.
1924	1,220,561	1,051,544	482,814	1,005
1925	1,400,000*	1,151,000*	600,000**	1,000*

*1925 estimated. **Based on Commerce Reports for 9 months.

It is apparent that exports have contributed in no small measure to the expansion of the market for American sulphur. Practically all of it sold outside of North America is distributed by the Sulphur Export Corporation. By agreement with the Sicilian producers a more stable condition in the world markets has been induced. That a considerable improvement has taken place in the Sicilian industry under the present arrangement is evident from the fact that in 1922 they produced only 137,648 tons, in 1923, 207,092 tons, in 1924, 241,156 tons, and for the first six months of 1925 the indications show about the same production as the year before. The importation of sulphur is very small, and has ceased to be a factor in the American market.

For certain uses, such as the vulcanization of rubber, the preparation of agricultural sprays and dusts, the refining of oil, and the manufacture of sulphite pulp, elemental sulphur is without a substitute or competitor. In the sulphuric acid field, however, iron pyrites can be and is used in certain installations. The preference is for sulphur, which requires handling only one-half the incoming tonnage of raw materials, and produces no residue of cinder to be removed. The other chief source of acid is that made from the waste gases from smelters using sulphide ores. While every ton of acid so made affords competition to that made from sulphur, it is interesting to note that with the demand for metal dull and for acid brisk, it is quite common to boost the yield of sulphur di-oxide gas above that normally obtained by adding elemental sulphur to the smelter charge.

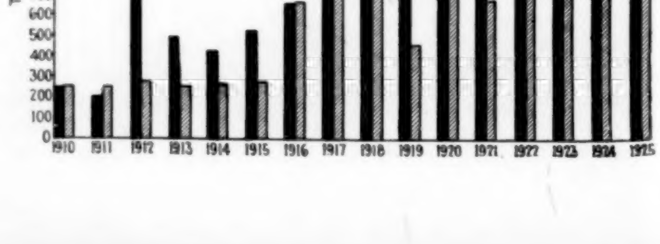
The situation with iron pyrites both as regards the imports and domestic production is shown in the following table:

	Domestic Production, Tons	Imports, Tons
1910	241,612	803,551
1911	301,458	1,006,310
1912	350,928	970,785
1913	341,338	850,592
1914	336,662	1,026,617
1915	394,124	964,634
1916	439,132	1,244,662
1917	482,662	967,340
1918	464,494	496,792
1919	420,647	388,973
1920	310,777	332,606
1921	157,118	216,229
1922	109,043	279,445
1923	181,628	263,695
1924	160,096	246,737
1925	160,000*	300,000*

*Estimated.

Sulphur is one of the few commodities that sells below its pre-war level. For the past year the value of sulphur exported, as shown by the Commerce Reports, has increased $1.20 per ton over that of 1924. During the latter months of the year a stiffening of the price in the domestic market was noted. In 1924 the production failed to equal shipments by about 300,000 tons. The same condition obtained in 1925, so that the decreasing of stocks by 600,000 tons in the past two years has probably been productive of the slight advance.

With exports of sulphur attaining their largest tonnage to date, and the domestic equalling the high mark of 1923, the market for sulphur in 1925 will exceed any previous year by at least 100,000 tons.



Wood Distillation Products Enter Many Industries

Three primary products—crude methanol, acetate of lime and charcoal—bear close relation to product of dyes, white lead and charcoal iron

By M. H. Haertel
The Miner Edgar Company, New York City

FOR many years the author of this article was on the faculty of the University of Wisconsin, where he received his Ph.D. degree.

In 1920 he joined the Miner Edgar Co., refiners and producers of methanol and formaldehyde.

He represents his company in the National Wood Chemical Association, being on the Membership and Legislative committees. He is also on the special committee of Producers and Refiners of Methanol.

DISTILLATION of hardwood to yield the three primary products—crude methanol, acetate of lime and charcoal—is one of the oldest of the American chemical industries.

Crude methanol is bought and sold on a basis of 82 per cent methanol content. It is shipped almost exclusively to refineries, and does not enter into general trade. Acetate of lime is sold on a basis of 80 per cent acetic-acid content with price adjustment for over or under this percentage. The charcoal unit is the bushel of 20 lb. for which the railroad weights govern. It is screened before it is shipped; beyond this, there is no attempt to meet specifications.

The capacity of a crude wood-distillation plant is measured by the number of cords carbonized per day. That is, a 40-cord plant, in trade parlance, means a plant that will normally carbonize 40 cords for each operating day. Assuming that a plant is closed for 10 per cent of the time, a 40-cord plant will carbonize approximately 13,000 cords per year. In general, the yield from one cord of wood (8 ft. x 4 ft. x 4 ft. 4 in.), is as follows:

Crude Methanol, 82 per cent methanol content, 10 gallons.

Acetate of Lime, 80 per cent acetic acid content, 200 pounds.

Charcoal (bu. of 20 lb.), 50 bushels.

The most recent government statistics report a total distillation capacity in this country of 4,639 cords. Canada has 460 cords. There are about 85 plants in the United States.

The principal varieties of wood are beech, birch, and maple although a few plants operate on a large percentage of oak. There probably is little actual difference in the yields obtained from these various woods, although there is a general opinion that beech is the most valuable. The plants are naturally located in the hardwood districts of the United States. The great majority are in New York State and Pennsylvania. There are a few in West Virginia and Tennessee. A number of very important plants are located in Michigan, where they are operated in connection with the lumber and iron industries.

Crude methanol, approximating 82 per cent methanol content, is shipped to the refineries, of which there are five in this country. Two of these are located in Michigan, two in New York and one in Pennsylvania.

In considering Table I, which is based on reports made to the United States Department of Commerce, due attention must be paid to the last three columns. It will be noted that only about 80 per cent of the total cordage capacity is reported. Bearing this fact in mind, we find that the table indicates a total production of crude methanol in the United States and Canada for 1925 of about 9,000,000 gallons.

Statistics on methanol refining have been published for only a few months. They indicate, however, that the total output of refined methanol during 1925 will be a little short of 6,000,000 gallons. Table II shows figures for each month from April to November, 1925, inclusive, and comprises the following grades of methanol: 95 per cent refined methanol, 97 per cent refined methanol, pure methanol, C. P. methanol and denaturing grade methanol.

There are four recognized grades of refined methanol:

Grade	Per cent of Total Refined	Number of Gallons
Pure (99½ per cent Methanol, containing less than $\frac{1}{10}$ of 1 per cent of Acetone)	60	3,600,000
95 per cent—97 per cent methanol	5	300,000
Denaturing grade methanol	25	1,500,000
Methyl acetone	10	600,000
Total	100	6,000,000

The various grades of methanol are shipped in tank cars, in 110-gal. drums and in 55-gal. drums. Tank car prices are usually quoted freight allowed, drums are sold f.o.b. refinery or store-door delivery. During the years immediately following the war prices were highly inflated, running up to $4.50 per gallon for the pure. There was a sudden collapse in 1921, and since then there have been orderly market fluctuations. In December, 1925, tank-car prices were quoted as follows:

	Cents per Gallon
Pure	65
95 per cent—97 per cent	55-57
Denaturing grade	65
Methyl acetone	75

It is generally recognized that these prices for the last few years have been somewhat below production costs, excepting in the most efficient plants. The correctness of this assumption is borne out by the fact

Table II—Methanol Refining in the United States and Canada, April to November, 1925

Year and Month	Crude Methanol (in gallons) Purchased[1]	Crude Methanol Consumed	Crude Methanol Stocks (end of month)	Refined Methanol (in gallons) Produced	Refined Methanol Stocks (end of month)
		UNITED STATES			
1925					
April	430,377	581,181	1,785,550	474,701	717,853
May	390,831	588,073	1,869,327	416,227	715,100
June	336,740	480,057	1,461,989	375,040	669,861
July	395,832	645,490	1,543,375	394,207	554,261
August	435,423	621,670	1,465,549	525,683	575,492
September	454,391	619,182	1,362,188	509,195	526,176
October	681,985	905,952	1,064,365	671,808	515,917
November	597,836	809,507	856,751	655,541	495,492
1926		CANADA			
April	....	37,928	65,643	36,680	68,477
May	....	26,465	58,648	25,800	50,344
June	....	17,493	55,475	17,200	51,551
July	....	21,641	42,944	20,700	52,459
August	....	......	42,077	......	32,007
September	....	22,188	19,889	21,185	40,129
October	....	12,200	36,606	11,500	32,443
November	....	40,895	33,186	39,200	40,846

(1) Does not include crude methanol produced by refinery.

that there has been a steadily increasing mortality among the older plants.

More than half of the pure methanol is used in the manufacture of formaldehyde. The next most important use is in preparation of dyes and intermediates. The pyroxylin plastics industry uses the pure 97-per cent and 95-per cent grades. The lower grades and methyl acetone are used in paint and varnish removers, lacquers, shoe polishes and dressings. Denaturing grade methanol is used exclusively for denaturing ethyl alcohol.

Acetate of Lime and Charcoal

The annual production of calcium acetate is about 160,000,000 lb. It is used almost exclusively in the manufacture of acetic acid, and of the acetates, principally ethyl acetate and butyl acetate. It is shipped directly from the wood-distillation plant to the consumer in car lots (about 50,000 lb. to the car), packed in burlap bags of about 160 lb. each. It is usually quoted on a basis of New York freight allowed, gross for net, that is, no allowance is made for the weight of the bag. The lowest price in recent years was $1.75 per cwt., at which figure some plants were compelled to throw away their lime sludge. From that price it has risen to $3.25 per cwt.

The annual production of charcoal is about 45,000,000 bu. of 20 lb. each. The principal use is in the manufacture of charcoal iron in Michigan and Tennessee, in the production of charcoal iron tubes from blooms, and in the refining of copper. In the cities along the Atlantic Seaboard large quantities of charcoal are packed in small paper bags and sold by grocers as domestic fuel.

The grinding of charcoal for special purposes, such as poultry feed, gun powder, steel treating, is an industry in itself. Before charcoal is loaded into cars at the chemical plant, it is run over screens, the screenings being collected in burlap bags. An additional quantity of screenings is collected by the baggers for the domestic trade. These "fines" are ground to various specifications, care being taken to eliminate all foreign material. The most important grinders are located in Philadelphia and New York City, and in the western portions of New York State and Pennsylvania.

Owing to this domestic use, the price fluctuates with the seasons. In 1925 the summer price was 13 to 14 cents per bushel f.o.b. plant, the winter price, 16 to 18 cents. It is sold only in car lots.

Formaldehyde. The only statistics for the production of formaldehyde are those published semi-annually by the Bureau of the Census and reported in the following table. The principal use of formaldehyde is in the manufacture of synthetic phenolic resins such as Bakelite. It is also used extensively for embalming, for disinfecting and as a raw material in the dye industry.

Table III—Formaldehyde Production as Reported by the Census of Manufactures

	1923	1921	1919	1914
Number of establishments	8	5	6	3
Total production, pounds	27,192,431	9,657,409	25,006,815	....
For sale—Pounds	20,213,873	6,056,483	19,663,753	8,426,247
Value	$2,604,061	$651,681	$3,938,322	$655,174
Average per pound	$0.13	$0.11	$0.20	$0.08

Menace of Synthetic Methanol

A few years ago the production of synthetic acetic acid in Canada and abroad began to cut into the export

Table I—Operations of the Hardwood Distillation Industry of the United States and Canada During 1925, as Reported to the United States Department of Commerce

Year and Month	Acetate of Lime (in pounds) Production	Acetate of Lime Shipments	Acetate of Lime Stocks End of Month	Methanol (in gallons) Production	Methanol Shipments (or use)	Methanol Stocks, End of Month	Wood (in cords) Consumption	Wood Stocks, End of Month	Capacity (in cords per day) Total in Industry	Capacity Reporting	Capacity Shutdown
					UNITED STATES						
1925											
January	11,589,955	10,048,474	15,367,465	573,333	586,331	1,305,058	62,614	518,058	4,807	3,700	251
February	10,414,270	9,611,100	16,214,894	542,397	521,854	1,365,830	55,351	516,441	4,807	3,700	275
March	11,372,813	10,886,087	17,382,596	592,636	513,966	1,713,594	61,430	564,249	4,807	3,908	293
April	11,580,597	9,182,209	19,130,254	606,197	549,122	1,617,934	62,678	573,622	4,807	3,908	411
May	12,269,654	12,631,276	18,817,017	631,257	571,996	1,692,153	65,284	581,548	4,807	3,908	479
June	10,821,839	12,811,614	16,678,074	562,638	576,526	1,682,308	59,538	556,817	4,807	3,908	495
July	11,448,631	10,389,589	17,760,129	605,379	596,577	1,705,156	62,615	463,904	4,639	3,776	423
August	11,971,359	11,402,040	16,803,815	577,883	638,500	1,490,013	61,519	529,294	4,639	3,728	459
September	11,114,339	12,334,945	15,083,650	534,412	605,098	1,413,625	59,144	495,043	4,639	3,668	507
October	11,093,858	12,224,031	13,586,632	555,629	736,592	1,237,299	58,493	476,386	4,639	3,668	733
November	11,201,798	12,011,964	12,805,960	566,726	685,808	1,146,303	60,129	444,716	4,639	3,668	721
Total (11 mos.)	124,879,113	123,533,329	....	6,348,487	6,582,370	....	668,795	....	......	......	...
					CANADA						
1925											
January	1,030,740	690,492	1,056,103	41,780	34,400	8,815	5,240	103,195	460	460	120
February	1,487,000	1,000,000	1,060,395	59,775	52,528	16,062	7,466	108,861	460	460	168
March	800,607	1,041,560	988,950	33,507	36,709	12,860	4,154	97,095	460	460	264
April	804,418	596,447	1,100,176	33,045	37,905	8,000	4,141	92,971	460	460	264
May	793,435	181,486	1,234,294	31,849	29,927	10,922	3,976	88,995	460	460	264
June	516,571	907,434	578,190	20,992	14,400	17,514	2,720	86,795	460	460	336
July	403,860	10	1,024,852	16,889	9,600	24,803	2,060	85,195	460	460	336
August	47,852	96,045	972,658	2,161	6,888	20,076	260	84,995	460	460	420
September	44,699	247,073	780,285	2,558	2,558	22,634	330	84,635	460	460	440
October	126,204	....	906,488	5,660	7,000	28,986	632	84,395	460	460	420
November	97,441	95,300	908,629	7,753	13,186	23,747	923	83,995	460	460	420
Total (11 mos.)	6,152,827	4,855,847	....	255,969	245,101	....	31,902	....	...	...	...

of acetate of lime. There were important importations of acetic acid from Canada. The year 1925 brought a large amount of synthetic methanol from Germany. The first considerable amount was 63,000 gallons in February, rising to a peak of 115,000 gallons in May. Since then there has been a gradual reduction to 42,000 gallons in October. The total importations up to the end of October was 415,000 gallons.

Although this imported material competes only with the pure domestic grade of methanol, it is a factor that cannot be neglected. Since the industry as a whole has been operating for some years at a loss, this German importation, if unchecked, would mean the further closing down of plants, with an increased price for the essential lower grades of methanol and the other products of wood distillation.

The development of synthetic methanol in Germany has from the beginning been observed with great interest by the wood-distillation industry. Since the new process is entirely different from wood distillation in use of basic materials, in equipment, and in location requirements, it is not one to which our industry can be adapted. While the leading manufacturers were not oblivious of the possible menace involved, no definite attitude toward the newly created situation could be taken until quantity importations occurred in February of 1925. The monthly imports are shown in Table IV.

Table IV—Imports of Methanol into the United States During 1924 and 1925

	Gallons	Value
1924 (Entire year)	48	$29
1915 January	40	29
February	62,971	29,420
March	69,886	26,976
April	9,012	5,201
May	115,120	52,917
June	61,045	26,504
July	7,847	3,865
August	48,410	21,493
September	8,413	3,941
October	42,000	......
November	....	......

Investigation of the situation in Germany met with various difficulties. The process has been employed in factory practice for so short a time that it would be difficult even for the operators to determine costs accurately. The officers of the Badische Anilin und Sodafabrik, who own the patent, are naturally unwilling to commit themselves. As a result, cost figures have appeared in print that are little less than grotesque, ranging as low as four cents per gallon and as high as thirty-two cents. The confusion is increased by the sales arrangement in Germany, whereby the "Badische" keeps in close touch with the German wood distillation industry, represented by the "Holzverkohlungsindustrie A. G." (H.I.A.G.), an agreement that enables the latter to maintain domestic prices at a level that permits it to live. Enough is known however to make it obvious that the present duty of twelve cents per gallon is not sufficient to equalize costs abroad and in America.

Since it would be fatal to several branches of American industry, especially to dye manufacturers, to be dependent on foreign production for a supply of necessary raw material, it is essential that the American methanol manufacturers be protected at least till the synthetic process is employed in this country to such an extent that our domestic demand can be satisfied. Application for remedial action has accordingly been made in Washington. A petition has been made to the United States Tariff Commission asking that the duty on methanol be increased by 50 per cent.

Byproduct Coke Establishes New Record

Although the total production of coke in 1925 was a trifle less than in the two war years 1917 and 1918 and only about equal to 1920, the output was notable because more than ever before in history came from byproduct ovens. Approximately 57,500,000 tons of coal were carbonized in the byproduct ovens during the year, with a production of approximately 40,000,000 tons of byproduct coke and corresponding quantities of byproducts.

The following table summarizes the estimated output of these byproducts on the assumption that the ratio of each to the coke produced was the same in 1925 as during the preceding year. These estimates are undoubtedly approximately correct, and no more accurate statistics will be available for about six months:

Coal charged	57,500,000 tons
Coke produced	39,823,000 tons
Screenings and breeze produced	3,500,000 tons
Tar produced	495,000,000 gals.
Ammonia produced (sulphate equivalent of all forms)	640,000,000 tons
Gas produced	630,000,000 M cu.ft.
Crude light oil produced	150,000,000 gals.

In the table is given the production of byproduct and beehive coke in the United States for a number of years past. It is evident from these data that, although byproduct coke made a record, beehive coke was produced in only nominal tonnages. The output in 1925 of beehive coke was about 4 per cent greater than the preceding year, but only about half that in 1923 or other post-war years, except the years of depression, 1921 and 1922.

PRODUCTION OF BYPRODUCT AND BEEHIVE COKE IN THE UNITED STATES

Year	Net Tons produced			Per Cent of Total Output Byproduct
	Byproduct	Beehive	Total	
1913	12,714,700	33,584,830	46,299,530	27.5
1915	14,072,895	27,508,255	41,581,150	33.8
1917	22,439,280	33,167,548	55,606,828	40.4
1918	25,997,580	30,480,792	56,478,372	46.0
1919	25,137,621	19,042,936	44,180,557	56.9
1920	30,833,951	20,511,092	51,345,043	60.0
1921	19,749,580	5,538,042	25,287,622	78.1
1922	28,550,545	8,573,467	37,124,012	76.9
1923	37,597,664	19,379,870	56,977,534	66.0
1924	33,984,000	10,286,000	44,270,000	76.9
1925 (est.)	39,823,000	10,644,000	50,467,000	78.8

The average monthly production of byproduct coke in 1925 was of course the greatest in history. Furthermore the production continued throughout the year with but little variation. Most of the changes in coke demand were made by changes in the rate of production of beehive coke. During the summer months, when there was somewhat lessened demand for coke, the output from beehive ovens was only about 40 per cent of that during December. It is evident from these facts that the beehive ovens are now serving almost exclusively as the balance wheel of the industry, affording increased or lessened output as demanded.

The average yields of coke and byproducts per ton of coal charged into byproduct ovens has increased slightly from year to year for some time past. As 1925 operations were more nearly at oven capacity than during the preceding year, it is unlikely that the byproduct yield increased materially per ton.

Markets for Pitch and Road Materials Influence Tar Refining

Cresylic acid for condensation products, creosote for wood preservation and production of synthetic phenol affect tar products

By S. R. Church
Consulting Chemist, New York City

MR. CHURCH writes with authority on the the subject of coal tar, having been in the industry for 25 years.

He studied chemistry at Pratt Institute, Brooklyn, and entered the employ of the Barrett Co. as chemist in 1900. From 1911 to 1925 he was manager of research and technical advisor.

In technical societies he has been active on committees standardizing methods of testing tar products and extending their industrial uses.

COMPLETE statistics for 1925 are not available, but it is safe to say that the production of coal tar in the United States has increased. This is due mainly to the continuous activity in the steel industry throughout the year, especially during the last quarter. The total coal tar production, including by-product coke oven tar and gas works tar was probably close to half a billion gallons, valued at approximately \$25,000,000.

More than one half of the tar produced in coke ovens, over two hundred million gallons, continues to be burned. Many producers of coke oven tar burn all or part of their make in open hearth furnaces, and esteem it highly for this purpose. The advantages of having a controlled supply of liquid fuel of low sulphur content and high thermal value cause some producers to place on their tar a higher value than its equivalent volume of petroleum fuel oil.

The tar sold includes about 50,000,000 gal. of gas works coal tar, over 200,000,000 gal. of coke oven tar, and upwards of 50,000,000 gal. of water gas tar. The latter yields no products which fall in the coal tar category, excepting almost negligible amounts of solvents and naphthalene and a small quantity of creosote oil. Most of it is used as road tar.

Of the coal tar sold, nearly one hundred million gallons is used as road tar. This contrasts with about 20,000,000 gal. used for the same purposes in 1915; the increased volume of this commodity is one of the outstanding features of the industry's development during the past decade. Part of the road tar is subjected to distillation with recovery of tar acid bearing oils, but the larger part is not. Most of the remaining coal tar, or roughly 150,000,000 gal. is distilled to pitch.

The conditions heretofore described, together with the not easily expanded limit to the outlet for coal tar pitch, tends to hold down the volume of tar distilled and restrict the increased production of certain tar products that now fall far short of filling domestic requirements. The most notable example of these is creosote oil, which was imported in 1924 to the extent of 80,000,000 gal. Imports for 1925 will at least equal and probably exceed that figure. In 1924 the consumption of creosote in the United States exceeded 150,000,000 gal. This consumption, from 1903 to 1924, is shown in the accompanying chart.

Another coal tar product in which shortage of domestic production has caused much concern to both producers and consumers is tar acid in its various technical grades. The shortage of phenol has been relieved by the re-establishment, during 1923, of synthetic phenol, produced for the first time since 1918. The synthetic product now exceeds the natural.

Cresylic acid falls far short of supplying the demand and large quantities are imported, mostly in duty-free grades, some of which is capable of yielding considerable proportion of the desired grades by refinement. During this shortage every effort has been made by the American tar distillers to recover the highest possible proportion of potential cresylic acid, within economic possibility.

Factors which would contribute to relieve this constriction of the coal tar industry are increased outlets for pitch at good value and increased localization of tar distillation, which would eliminate the burden of high freight charges.

An interesting development in this latter direction is the recent installation by a steel company of a plant for partially distilling its tar before burning, with recovery of light and carbolic oils. The tar distillers have already demonstrated that the soft pitch, or under certain conditions even hard pitch can be burned in liquid form. The outcome of this undertaking will undoubtedly be watched with close interest by tar producers who are burning crude tar.

According to the Tariff Commission, the production of crude coke oven light oil was 101,000,000 gal. in 1922, 136,000,000 gal. in 1923, and 129,000,000 gal. in 1924. The production for 1925 may reach 140,000,000. Assuming that the optimistic views of the leaders of the steel industry are justified, we may expect continuance of conditions which will result in increased production of coal tar and light oil in 1926.

Not for years has the gas industry shown such signs of activity as at present, and the trend toward coke ovens for city gas is strongly apparent. Signs of the times are: the ease with which surplus coke is absorbed by the domestic fuel markets, the benefit to the public of having well distributed reserves of coke available to meet emergencies in the anthracite coal situation, and such items of news as the recently expressed desire on the part of a large group of pig iron users to localize their supplies of pig iron and foundry coke, by establishing furnaces and coke ovens, with gas as a by-product.

It is within the bounds of possibility that developments during the next three years may result in an increase of 25 per cent in the production of coke oven tar and light oil, and it is not too much to hope that the proportion of tar distilled will at least keep pace with this increase.

Coal Tar Products

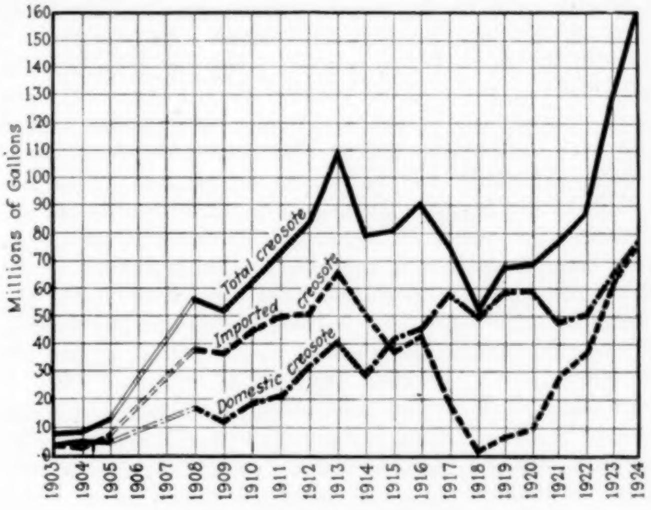
The coal tar products industry is somewhat more fortunate than others of the chemical industries in that its statistics of both production and imports are collected annually and in considerable detail by the United States Tariff Commission. The annual publications "Census of Dyes and other Synthetic Organic Chemicals" (available for 1917-1924) have been drawn upon freely for statistical information in the following discussion and the reader desiring more detailed data is referred to that source.

Anthracene. This commodity was a nightmare to the tar distillers and dye stuff manufacturers from the beginning of our war activity until about two years ago. During the period 1917 to 1920 efforts on the part of the producers resulted in increasing the production of refined anthracene from practically nothing to 700,000 lb. Since 1920 it has been evident that synthetic anthraquinone would largely eliminate anthracene. The maximum production of anthracene reached in 1920 was about 3,000,000 lb. of crude, equivalent to seven to eight hundred thousand pounds anthracene. The maximum imports of crude, 800,000 lb. was in 1923. The best grade of anthracene produced ran about 86 to 88 per cent purity. Specifications are usually based on anthracene content. Carbazol is the principal impurity. With phthalic acid produced at such low cost as it is now, it is doubtful whether anthracene will ever again be a factor of much consequence in the United States coal car industry.

Cresylic Acid. In addition to U. S. P. cresol and the commonly designated 97-99 straw color, and 95 dark, there are now several special specifications covering grades desired by large users for their individual requirements. These include principally the grades used in the manufacture of condensation products. It is understood that one important specification requires minimum and maximum limits of meta-cresol content. Hence, before evaluating tar acids from any new or unusual source, a careful study of their constitution will be necessary.

A reliable estimator places the present yearly consumption of all grades of cresylic, not including acids in tar acid oils, at 8 to 10 million pounds. Of this, probably one half or more is used in formaldehyde condensation products. Statistics of the Department of Commerce for the first ten months of 1925 show imports of 2,300,000 lb. of "Cresylic Acid" and 2,400,000 lb. of material as "other distillates," duty free. England has been said to make 40 per cent of the world's total cresylic acid production, but that figure probably does not take into account the notable increase in U. S. production during the period since the new tariff became effective.

It has been noted that about 150,000,000 gal. of tar is distilled to pitch. If from two-thirds of this a complete recovery of cresylic acid could be made, it would about meet the present demands. This at present is practically impossible for various reasons including: not all of the tar plants in the country are equipped to



Consumption of Creosote from 1903 to 1924

In this chart the figures for 1906 and 1907 were not available. The volume of domestic creosote here shown is greater than the actual production reported by the Tariff Commission. This is due in part to use of coal tar and water gas tar mixed with creosote

extract tar acids; the distance from many tar works to the nearest points at which equipment for refining cresylic acid is available is too great to justify the freight cost of moving the raw material.

The future of the tar acid situation affords ample opportunity for speculation. If synthetic phenol can ever be produced cheaply enough, it might largely supplant cresylic in the condensation products field. The advent of low or medium temperature carbonisation processes for the production of primary smokeless fuel, offers the possibility of a new type of tars rich in tar acids. Will these acids yield the desired grades of cresylic to meet present requirements? Analyses of tars from many experimental and a few commercial processes of this class, shows the acids to be mainly of higher boiling range and greater molecular complexity than the cresols. Nevertheless, the fact that tars of this type often contain five to six times as much total tar acids as ordinary coal tars, makes them a factor of possible importance in regard to future tar acid supplies.

Creosote Oil. The grades and specifications for this commodity are not of interest to the readers of this article. It is pertinent to say, however, that there is very little ground for often-heard statements that on the one hand the use of creosote oil in such large volume for wood preservation is depriving the coal tar chemical industry of certain crudes, or on the other hand from the wood preservers' standpoint, that creosote oil is being deprived of some of its normal constituents, in order to supply the coal tar chemical market. Naphthalene is practically the only material which now figures as an important coal tar crude for the chemical industry, and at the same time a normal ingredient in creosote oil. Fortunately there is ample naphthalene to supply the former, which can be recovered from the light and carbolic oils, without necessitating the removal of naphthalene from any of the wood preserving creosotes.

The use of creosote oil has increased to a notable degree during the past two years. During 1923 creosote again began to come from Europe in large volume and in 1924 and 1925 imports exceeded all former records. Domestic production has increased slowly but is now farther than ever short of total requirements. The present estimated consumption is about 160,000,000 gal.

annually, and if increased supplies are available this consumption will undoubtedly continue to increase.

A large part of the creosote used for treating ties is mixed with ¼ to ⅓ its volume of coal tar. This not only extends the creosote supply but affords better physical protection against checking, etc. Some railroads, especially in the southwest where tar is not locally available, are mixing petroleum with creosote oil. Hence there exists an apparently anomalous condition, that large quantities of creosote are being burned in the form of tar, while petroleum (not a preservative in the chemical sense, at least) is used to eke out the supply.

The importance of creosote as an article of import is perhaps not generally appreciated. During 1925 it was the second largest single item, both in volume and value, in the class of "Chemical and Allied Products" coming into the United States. Its value as an import item is greater than the combined values of all other coal tar chemicals including all dyes, colors and intermediates. England and Germany are the largest exporters into the United States. Japan has entered the Pacific Coast market.

The future trend of world markets for creosote may have an important bearing on the future development of the coal tar industry in the United States. Reports from abroad indicate a world-wide increase in the use of preserved timber, and general recognition of creosote as the standard preservative.

Naphthalene. Naphthalene as a moth repellant has a seasonal demand which can be quite closely estimated, but the demands of the intermediate and dye manufacturers appear to have been erratic. At the close of the war stocks of crude and refined were so large that some thought no further production would be required for years. While there has been no marked improvement in the consumption of naphthalene in the drug trade, its use as a raw material for intermediates has exceeded expectations, over a period of years, although the yearly fluctuations continue.

During 1923, of the naphthalene intermediates, b-naphthol and H-acid reached a total production of 9,500,000 lb. These declined sharply during 1924, but phthalic acid continued to increase and now constitutes one of the most important demands for naphthalene. The average annual demand for refined grades seems to be about 20,000,000 lb. Sales for 1925 will probably exceed 1924 and will fall considerably short of 1923.

Importation of naphthalene is confined to crude, but the present tariff permits "crudes" of such high melting point to enter duty free that some of it at times has been no doubt used without further refining, although inferior to the quality of domestic grades. The price of flaked naphthalene today is about 7 cents. In 1913 it sold at 2½ cents, during 1916 it reached 16 cents.

Phenol. The extent to which synthetic phenol now dominates the market is apparent by noting that in 1924 the production of phenol was over 10,000,000 lb. against 3,300,000 lb. in 1923. Natural phenol is supplying the drug trade and is apparently preferred over the synthetic product, but the price is controlled by the latter.

The estimated annual demand for phenol is 12,000,000 lb. and is increasing. Not much increase in the production of the natural product can be expected. After years of price fluctuation extraordinary, the price of phenol, always assuming continued tariff protection, will probably continue at or near present levels.

Phenol finds its principal use in the phenolic condensation products. The normal demand for the drug trade and for intermediates and chemicals is about 3,000,000 lb.

Pyridine. The only important use for pyridine in the U. S. at present is as a denaturant. There is only a limited amount of domestic pyridine on the market and considering the imports for the first ten months of 1925 of 631,000 lb., valued at $314,000, it would seem at first glance that domestic producers were overlooking a good bet. This is probably not the case, as the appearance of large domestic supplies would undoubtedly result in a sharp break in the price of imported pyridine. Further, the manufacture of pyridine requires considerable plant expenditure, and the turnover of a large amount of raw material. There is also great uncertainty regarding the life of denaturant formulas. Only a few days ago formula No. 6, one of those requiring pyridine, was cancelled.

Carbolic Oil. This designation applies to tar oils free from naphthalene containing specified percentages of tar acids, usually between ten and thirty, and used for making dips, disinfectants, insecticidal sprays, and the like. No production figures are available. Price depends on tar acid content. A few years ago the use of oils of this type as flotation reagents on copper and other low-grade ores, reached a volume of 2 or 3 million gallons annually, and this was the controlling factor over price and supply of these oils. This demand has now largely disappeared, owing to the popularity of chemical reagents, such as xanthate.

Miscellaneous Tar Oils, Refined Tar and Pitch. Aside from the use of creosote in wood preservation and the oils of specified tar acid content, tar oils are not used widely enough to make it possible to say anything about these uses in a market report, excepting to mention the burning of tar oils in lamp-black production, use in manufacture of shingle stains, and as fluxes in various compounding processes.

In like manner it is difficult to deal with refined tars and pitches, since these products are scarcely mentioned or quoted in trade or technical journals in the United States. Nevertheless, pitch is a very important commodity, its annual production reported by the Tariff Census is about 400,000 tons, and the market trend of this material is bound to effect the cost, and ultimately the price of all coal tar products, since pitch is an inevitable product of coal-tar distillation.

The coal-tar industry in the United States differs from that of Europe, and this is especially true in respect to the outlet for pitch. There it is a commodity in large and regular demand as a binder in fuel briquettes. Pitch is quoted in European chemical and trade journals as regularly as is naphthalene. There is no single use for pitch in this country that approaches briquette pitch in volume. Recent reports from London show an active market in pitch at upwards of 50 shillings per ton. Occasionally the European demand is such that pitch can be exported from this country. There is, however, no regular export market for pitch, nor does it seem likely that there will be in the future.

Some of the more important uses for pitch in the U. S. are: Composition roofing, manufacture of carbon electrodes, impregnating and coating formed or moulded fibrous materials (for example, fibre conduits), waterproofing for masonry structures, coating iron and steel pipe, manufacture of foundry facings and core com-

pounds, manufacture of cheap black paints, etc. No statistics can be given and the foregoing uses for pitch are mentioned only to bring before some of the users of coal tar chemicals a somewhat more comprehensive picture of the scope of the industry than is ordinarily found in a market review.

For the same reason, pitch coke may be mentioned as a commodity which is already of considerable importance and promises to become still more important. Two types of coke are produced commercially, one by direct distillation of tar to coke in stills, another by carbonizing very hard pitch in ovens. The former is used principally for carbon electrode manufacture, and for domestic fuel, the latter for special metallurgical purposes.

The Benzol Group

These products of coke oven light oil enter two distinct markets, viz.: Chemical, and automobile fuel, which must be discussed separately, although interrelated as to supply and demand.

Chemical Market

Grades: No universal standards have been adopted, but the following requirements indicate grades that are obtainable.

Benzene, highest purity or "reagent"
Boiling range, 1 deg. C. or less.
Acid wash, color 0 to —1.
Freezing point, 5 deg. C. or higher.
Practically free from paraffin.
Not more than traces of thiophene, H_2S, CS_2, SO_2 or SO_3.
(This quality of benzene has been made consistently for more than a year and is considered equal to the best European product).

Pure Benzene, highest regular grade.
Boiling range, 1 deg. C.
Acid wash, color 2 or less.
Freezing point, not less than 4.75 deg. C.

Commercially Pure Benzene.
Boiling Range 2 deg. C.
Acid wash test, 4 or less.

And the usual 100 and 90 per cent benzols.

Toluene, highest purity or "reagent."
Boiling range, 1 deg. C.
Wash test, 0 to —1.
Practically free from paraffin.
Free from more than traces of any sulphur compounds.
(This corresponds in purity to the similar grade of benzene).

Toluene, pure, regular grade.
Boiling range, 2 deg. C.
Acid wash test, 4 or less.

Xylene, pure, may be had in 5 degree and 10 degree boiling ranges, with corresponding wash tests and with very low impurities.

Xylol, commercial, or solvent naphtha.

These constitute the "Water White" grades. A higher boiling naphtha, sometimes known as heavy naphtha, or Hi-flash, which is quite or nearly colorless and of good odor is also available.

Consumption and Distribution: The estimated yearly requirements:

Benzols	
for chemical reactions	3,000,000 gal.
for solvent	9,000,000 gal.
for cleansing	500,000 gal.
for miscellaneous uses	500,000 gal.
	13,000,000 gal.
Toluols	
for chemical reactions	500,000 gal.
for solvent	3,000,000 gal.
for miscellaneous uses	250,000 gal.
Total	3,750,000 gal.
Xylols	
all purposes	1,000,000 gal.
Total chemical requirements for benzol group	17,750,000 gal.

The principal distributing districts for benzol (including motor fuel) are Chicago, New York (Metropolitan District), Pittsburgh, Cleveland District, Baltimore, St. Louis, Detroit, Birmingham and Cincinnati. During the past few years a number of stations have been installed in some of the foregoing districts by one of the largest distributors, for tank wagon delivery.

Motor Fuel Market

The estimated use of benzol for blending with gasoline has increased from about 50,000,000 gal. in 1920 to possibly over 100,000,000 gal. in 1925. The close of the war left benzol producers with two alternatives, a shut down of over 75 per cent of existing capacity, or the speedy development of a large outlet. Benzol as a motor fuel had already been proven in the United States and the demand was not slow in developing. Although prices were not at first always satisfactory, the present generally accepted basis of price is the cost of gasoline to the purchaser, plus freight on benzol from point of production. During the past year this has been about 17-18 cents, f.o.b. production point.

The present demands for motor benzol so fully cover the production of that commodity that a new demand for any grade of benzol or toluol in the chemical market results in a temporary shortage and increase in price on that grade. This is well illustrated by the present scarcity and high price of toluol and xylol caused by the suddenly increased use of these solvents in connection with rapid developments in the lacquer industry. Such conditions must inevitably right themselves.

PRICES FOR COAL TAR PRODUCTS IN RECENT YEARS

Product	Dec. 1925	1924	1923	1917 (or other)
Anthracene—80 per cent	$0.60	$0.65	$0.75	$1.00 (1919)
Benzol—90 per cent	.24	.23–.31	.32–.21	.90 (1916)
Cresol—U.S.P.	.20	.24–.18	.25–.27	1.50
Solvent Naphtha	.35	.24	.27	.30
Phenol—U.S.P.	.23	.37–.23	.58–.25	1.65 (1915)
				.085 (1913)
				.15 (1911)
				.23 (1901)
				.12 (1891)
				.40 (1881)
Toluene	.35	.26	.30–.26	6.00 (1918)
Xylene	.50	.55–.40	.65–.45	1.20
Cresylic—97-99	.55	.60	.80–1.30	.50 (1922)
				.40–.45 (1914)

Byproduct Ovens and City Gas

During 1925 a considerable number (about 150) of new byproduct ovens were put into operation for the first time. Most of these were built for the supply of city gas and are owned by public-utility gas-distributing companies. Substantially all of the increase in plant capacity for making gas from coal is included in this group of new city-gas ovens. The output of coal gas from retort plants was probably about the same in 1925 as during the preceding years. This production of retort coal gas has not varied materially since the war and there is evidence to indicate that a decrease in retort coal gas capacity may be expected.

Insecticide Sales Problems Remain Unsolved

Price cutting, caprices of demand, seasonal consumption and erratic movements of arsenicals combine to throw industry into disorder

By Howard W. Ambruster
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As a consulting chemical engineer, Mr. Ambruster has given special attention to the arsenic industry and to the manufacture of calcium arsenate for the control of the bollweevil.

He built and operated the first modern arsenic acid and arsenical insecticide plant in the U. S. Born in Pennsylvania, he was educated at Germantown Academy and the University of Pennsylvania.

There are many ways of classifying agricultural poisons. The entomologists group them broadly as stomach poisons, contact poisons and fungicides. As is evident from the names, the stomach poisons are those which are toxic when taken into the intestines of the insects; the contact poisons kill by inhibiting the respiratory system; and the fungicides are those agents wholly intended to control plant diseases rather than insects.

More detailed classification is required to cover the subject from the standpoint of the student of pest control, and would necessarily include the repellants which drive off the insect pests and the fumigants which throw off a deadly gas. Compounds belonging properly in both of these latter groups may also be stomach poisons or contact poisons.

From the standpoint of the producers of insecticides a broad chemical classification would probably be more intelligible. A crude classification on this basis might include (1) the arsenicals, (2) the sulphur group, (3) the oil and soap group, (4) the gas- or fume-producing group, and (5) the specialty or miscellaneous group, including nicotine.

The above classifications do not indicate the relative importance of lime, lead, and copper as insecticidal materials, but these are all so universally required in compounding with other elements that it would hardly be justifiable to consider them as other than raw materials used in the groups named.

Another and a very important classification from the producers' standpoint is that which would group insecticides generally as: (1) the tonnage items on which large volume of production is usual and distribution on a quantity or bulk basis is possible, (2) the standard small package products, some of which may be produced in large volume but which must be packaged to retail in hundred-pound to four-ounce lots, and (3) the specialties or proprietaries which may be produced in large or small volume but must be put in containers of sizes to attract the buyers' convenience.

It is the many complexities of definition, classification, and utilization that makes the insecticide industry hazardous to many of those who may have direct contact with some phase of it but little appreciation of the manifold problems that must be mastered in addition to the usual ones of production and distribution of any article of commerce.

Exact statistics of the production and consumption of agricultural insecticides are lacking and it will never be possible to more than approximate even the most important of them. The Department of Commerce has made the attempt recently to secure figures from the individual producers and compile totals which can serve as a guide to those involved. Not all of the makers cared to send in their figures, however, and the published reports on the few compounds canvassed were therefore acknowledged to be incomplete. Such statistics would be useful of course, if accurate, but the variable demand and changing conditions in the problems of insect control are such that even absolutely accurate figures would not paint a definite, easily read chart for the guidance of the producer of insecticides as is the case in many other branches of the chemical industries.

Of the four general groups named, the arsenical is by far the most important in tonnage and total value. This includes paris green, lead arsenate, calcium arsenate as the most important. Arsenical baits are largely home-made but should be included as in that case the arsenic is properly recognized as a pest control and comes therefore under the general heading of agricultural insecticides.

In round figures, 30,000 to 40,000 tons of arsenical insecticides are consumed annually in the United States. Paris green consumption is hardly increasing and with nearly all the entomologists advising the use of substitutes for it, its use is not expected to hold its own in the future. Lead arsenate is used for many different purposes and in widely scattered territories. Its use is increasing steadily, subject, of course, to the erratic nature of the demand that always will prevail for any agricultural poison. Calcium arsenate is the chief performer of acrobatics in its consumption figures. First used in any quantity in 1918 for boll weevil control, its consumption practically doubled every year until 1923 when it was variously estimated at 15,000 to 16,000 tons. On the theory that the increase in use was due to the education of the cotton planter by seeing his neighbor apply it, a consumption of 25,000 to 30,000 tons was predicted for 1924. But dry weather and low insect infestation in the South sadly upset the figures and a large carry over variously estimated at 10,000 to 12,000 tons resulted that season. The production for the 1925 consuming season was

much reduced but a large tonnage of new material was made and part of it forced on the market in direct competition with the stocks already warehoused in the south, much of which was in weak hands. The result was inevitable. Prices had sagged to cost and below during part of 1923, they dropped still lower in 1924; and in 1925, it is a safe statement that every carload that was sold by the producers represented a sizable loss when the freight and selling expense and an accurate overhead expense was figured.

This condition of price cutting might be blamed solely on a temporary oversupply were it not for the fact that selling below cost has been so frequently practiced in the insecticide industry at times when there was no real excess supply for a season's needs. The causes or incentives that have brought about this condition are buried deep in the many complex problems of a unique marketing enigma, the only outward manifestation being a spirit of resentful suspicion among the manufacturers as a whole.

Variations in Production a Disturbing Factor

When the selling price of the arsenical insecticides goes down, the selling price of arsenic should go down also and vice versa. It is somewhat doubtful which is the cause and which is the effect. Arsenic being largely a byproduct, the main part of the supply has no relation whatsoever to the demand. There have been periods during the recent past when the byproduct supply was wholly insufficient and it was augmented by the direct production of arsenic from a number of sources in this country and abroad. If that condition became fairly constant, the price of arsenic might easily drop from the peak, the total byproduct production is so frequently bid up to, down to a more nominal basis of profit over cost of direct production. But the price movement of byproduct arsenic must always be erratic. And until something else is substituted for calcium arsenate for control of the cotton insects the insecticide producer must always face this question of when to buy his arsenic.

The potential market for the arsenical insecticides has never been calculated by any official entomologist so far as is known. Several years ago, the very confusing practice of putting out contradictory statements about the arsenic supply and demand from the Washington bureaus ceased suddenly when the pertinent question was asked, "How can anyone say whether there is enough arsenic available until someone decides how much arsenic can be used for the farmers' economic good?" The question remains unanswered.

Unfortunately the problem is one of immediate availability at any given time when the bugs come, and not one of geological research into the mineral resources of nature. Between the transposition of the arsenic from the bowels of the earth to the intestines of the insect a lapse of time must occur.

Meanwhile arsenic is selling for less than 4c. in the New York market, which is less than even byproduct cost by any reasonable conception of cost accounting. And calcium arsenate is a drug on the market and cannot be sold in volume at any price, except on those jug-handled contracts for which the insecticide industry is notorious and on which the buyer obligates himself to accept an indefinite quantity of merchandise at an indefinite date and to pay for same at a price to be perhaps lower but not higher than the contract calls for. The seller in substance gives out a buyer's option for a full season on a part of his output without consideration and without possible profit. He may only lose, he can't win. Is it any wonder the insecticide industry is sick?

Turning from consideration of the arsenicals to the sulphur group, the latter include mainly lime and sulphur, solution and dry, sulphur dust, and numerous sulphur mixtures. Lime and sulphur is made by a great many small producers and most of the large ones. It is always in competition with the home-made product of the farmers themselves, and the freight on the water content is therefore an item which keeps each output in a fairly confined zone of availability from a transportation standpoint. The volume of consumption is largely and probably increasing the competitive spray materials are favored by many entomologists. Dusting sulphur is only produced by a limited number of makers and is a tonnage product for the reason that sulphur of much the same physical character is utilized largely for other requirements than insecticides, notably in the rubber industry.

The oil and soap group referred to includes a great number of different oils, compounds and emulsions. Most of them on the market are proprietary products covered with patents or trade marks, the numerous formulas have been published and recommended by state and federal officials. The use of mineral oil for insect control dates back many years, and recently the use of sprays of this type is undoubtedly increasing and has strong backing from the production side as well as many advocates among the agricultural experts. Vegetable and animal oils are also used largely in these numerous proprietary spray soaps and emulsions. The total volume consumed is large and as the proprietary compounds are not so competitive as the so-called standard insecticides the evil of price cutting or selling below cost is not so prevalent as in the arsenicals and the sulphur group. There are probably over one hundred different companies in this country making products which come within the above rough classification.

Sales Problems of Fuming Insecticides Easier

The gas- or fume-producing group include mainly carbon bisulphide, hydrocyanic acid and paradichlorbenzene. The production of all of these is in a few hands in connection with other products related to them from both the standpoint of production and consumption. As insecticides, they are side issues to a large extent but they represent a sizable total in volume and their marketing problem, although difficult, is not affected by many of the obstacles that inflict the so-called standard insecticides.

Among the other insecticides and fungicides not enumerated before and grouped broadly as miscellaneous or specialties, nicotine sulphate and tobacco dusts are by far the most important. For years the nicotine sulphate production was confined to only one maker but there are now several competitors in the field. Although the total volume of consumption is not great as compared with some of the tonnage items the use of nicotine is so diversified and well-intrenched that it has been considered an attractive field to be kept out of only on account of difficulties of process and restriction of raw material supply.

The Bordeaux mixtures should come under the miscellaneous group as they have not been mentioned

heretofore and are important both in usefulness and in volume. Home-made Bordeaux is one of the standbys of the progressive orchardist but the patented and trademarked Bordeaux mixtures find a large sale and are attractive, as the good-will of a proprietary after it is established, permits a profit in a partially non-competitive market.

The producers of insecticides may be grouped into 4 different classes, each of which have a fundamentally different contact with the market. They comprise (1) the miscellaneous chemical manufacturers, (2) the fertilizer producers, (3) the paint and varnish makers and finally (4) the companies which make insecticides and nothing else.

On another basis the producers might be grouped as the tonnage producers and the small package insecticide makers. But this distinction, important as it is from the effect it has of the viewpoint of the company, is hardly permissible because many of the manufacturers are in both classes.

Taking up the other method of classification, the first three of these groups are in the insecticide business purely as a side line and on a department basis. Without exception these insecticide departments rank low in comparison with other branches of these companies' total business.

Necessarily their conception of marketing problems is largely influenced by methods of distribution which are effective in their major lines and which are of very little value in handling the special problems of insecticide merchandising. They are nearly all very large corporations eminently successful in their special fields. An executive attitude of extreme irritation at the lack of profit from insecticide production seems to be substituted for the wise management and keen foresight with which the other lines of these various companies are directed.

The fourth class, those producers who make nothing but insecticides, are by far the most numerous though many of them are small and make only one or two special products for some local demand. The diversity of viewpoint which men so variously engaged in different and unrelated kinds of industry is one of the real obstacles to constructive association work or unity of that entirely legitimate character which exists in many other lines of manufacturing. The only common meeting point is on scientific or technical problems through the agency of state and federal officials and the latter are lacking in legal power to accomplish much along the line of reconciling the viewpoints of the different kinds of insecticide producers.

Standard Products on Unsound Basis

By far the most distressing phase of the agricultural insecticide industry today is the distribution or marketing. It is difficult and more or less haphazard in regard to the small package distribution of the standard products and the specialties; it is largely chaotic, unorganized and commercially unsound as to the tonnage product. The paint and varnish makers who are in the insecticide business naturally utilize their facilities for national distribution of their main products, to carry along the insecticide sales on the side.

Much of the total tonnage of miscellaneous insecticides goes to the consumer on a package basis and it might seem that the insecticide sales had a most convenient distribution through the same avenues which function to distribute paints and varnishes. This is only partially true, however, on account of the nature of the article. It is a special problem of merchandising that cannot be solved by the same methods successfully used for paints and allied products.

The miscellaneous chemical producers have no such sales and distributing organizations like those of the paint manufacturers, and must approach the distribution from a different angle. Their other sales are largely on a tonnage contract basis, finished products from their plants are the raw materials of the leather, textile and other industries. Retailing or selling jobbers in retail packages is entirely foreign to the regular sales campaigns of these makers. The fertilizer manufacturers have a still different sales viewpoint, as their principal products and the manufacturers who produce only insecticides of one or of many types, are faced with a picture of almost indescribable confusion in attempting to puzzle out the ways and means that are and may be used by their competitors.

Underselling Is the Real Trouble

An industrial leader known as a master salesman, who rose to pre-eminence as the head of a large organization making various products including insecticides, is quoted as authority for the following: "Getting rid of the product in volume at a profit is the object and at the same time the test of every successful business organization."

It may be unethical and it surely is in violation of the Sherman Act for producers of any commodity in this country to agree on either restriction of output or maintenance of price levels. But it is doubtful if anyone would contend that, from an ethical standpoint, deliberate selling below cost is not an economic and a commercial crime several degrees blacker than either restriction of production to a healthy volume or the fixing of prices at a level which will permit an industry to live.

On this problem of underselling it is not a sufficient explanation to lay the blame to that isolated type of producer and seller who can only be described as a "wrecker." If this name seems harsh, it should be understood that no other word can describe that type of operation.

If the legitimate insecticide manufacturers as a group will first learn to figure their costs with a proper suspense overhead included, and then resolve individually not to sell a pound of material except at cost plus a legitimate profit, this curable ill of the insecticide industry will vanish in short order.

Official buying of insecticides for distribution at the purchase cost direct to the farmers has been frequently resorted to as an emergency measure in face of dangerous epidemic infestation by some particular insect pest.

The State of Georgia purchase of calcium arsenate is the most notable example of this and the intrusion of politics, with the erratic performance of the market for the poison, finally brought about a condition that has probably put the state out of the business.

It should be said in this connection that if an official board be authorized or instructed by legislative enactment to purchase and distribute any article of merchandise, no one can properly object except on the authority of the Constitution. But if an official board or any other organization attempts to purchase on a basis which does not ensure the seller a definite price at definite delivery dates then the seller is the real culprit in offending all principles of sane business.

Expanding Market for Alcohols and Volatile Solvents

Production mounts rapidly to supply increased demand caused by pyroxylin lacquers, rayon and other like revolutionary commercial developments

By B. R. Tunison
U. S. Industrial Alcohol Co.
New York City

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MR. TUNISON graduated in chemical engineering from the University of Southern California and went directly into research and development work in the petroleum industry for the General Petroleum Corporation.

During the war he was engaged in developing a process and producing toluol from petroleum. In 1919 he came East and joined the technical staff of the U. S. Industrial Alcohol and Chemical companies. His present work in these organizations is the technical development of sales and distribution.

NINETEEN - TWENTY-FIVE was a truly remarkable year in the field of alcohols and solvents. For the most part, the development kept pace with the general improvement of industry; there have been a few instances where a depression is noted and several cases where the changes have been almost revolutionary.

Probably the most outstanding chemical achievement, and one of the most disturbing to the American chemical industry, was the production and importation into this country of synthetic methanol. During the entire year 1924, the importation of methanol amounted to 48 gal., valued at \$29. During the first quarter of 1925, 122,906 gal., valued at \$56,422 came into the country. The importations for the second quarter amounted to 185,178 gal. at \$84,622. The third quarter importation was 64,670 gal., at \$29,299.

The use of ethyl alcohol for industrial purposes has increased so rapidly that there are many who believe that there must be a substantial percentage of the material used for other than legal purposes. Most of these opinions, however, are formed without a careful analysis of the facts. Fig. 1 shows the increase in the production of denatured alcohol as compared with such other essentials as rayon, gasoline and copper. The rate of increase is not out of proportion to that of the other products. Copper, by many, is considered a reliable index of industry. The fluctuations of denatured alcohol and copper are quite parallel.

By far the largest single use for alcohol is as an anti-freeze for automotive equipment. The Industrial Alcohol and Chemical Division, Prohibition Unit, Bureau of Internal Revenue, made a very careful survey to determine the quantity of alcohol used for anti-freeze purposes. The results of their investigation indicated that last winter 28,000,000 gal. of alcohol were used in this manner. At that time, the motor vehicle registration was 17,592,000. The National Automobile Chamber of Commerce has recently estimated the motor vehicle registration to be in excess of 20,300,000. This great increase in connection with the greater percentage of closed cars in use and more general winter driving, indicates that in the 1925-26 season between 32,000,000 and 35,000,000 gal. of alcohol for anti-freeze would be used. This is nearly twenty times the total production of denatured alcohol for all purposes in 1907. This is a very large increase and this year, as in the past few years since the war, the anti-freeze demand has been the dominant factor in the increased production of denatured alcohol.

Another factor in connection with the increased production of denatured alcohol which is usually lost sight of, is the decreased use of pure, undenatured, alcohol. The decrease in the use of pure taxpaid alcohol is as follows:

1921	18,400,000 gallons
1922	8,600,000 gallons
1923	5,670,000 gallons
1924	4,940,000 gallons
1925	4,500,000 gallons

The Internal Revenue approval of formulas of specially denatured alcohol suitable for the manufacture of toilet and barber supply preparations, perfumes, etc., had a two-fold effect. As the substitution took place and the manufacturers learned to use the denatured product, the production of denatured alcohol increased and the use of the pure material was correspondingly decreased. The saving of the Internal Revenue tax of \$4.18 per gallon on the pure alcohol by using denatured, resulted

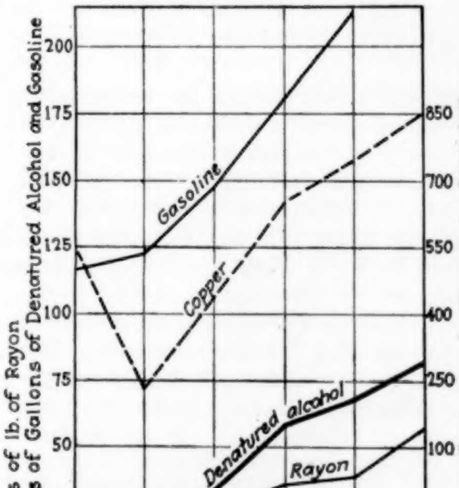
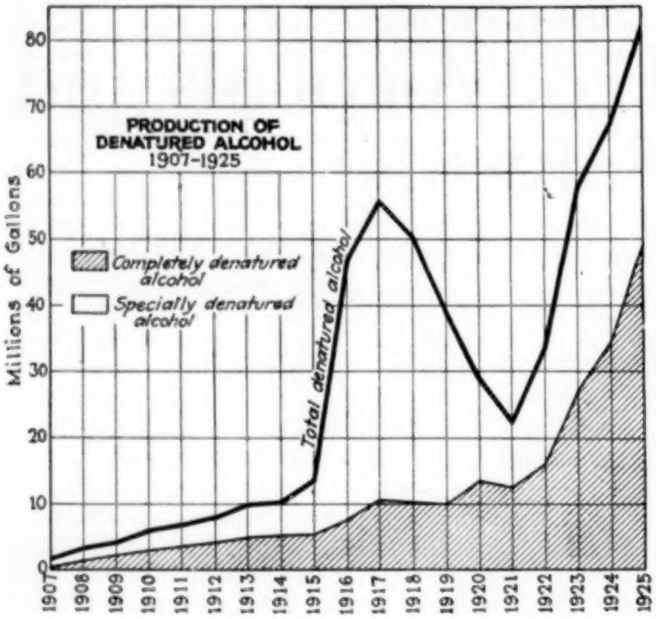


Fig. 1—Comparison of Recent Growth in Production of Denatured Alcohol, with that of Rayon, Gasoline and Copper



in lower costs, and these lower costs and selling prices caused a greater demand for the finished product.

One of the great uses for denatured alcohol which has made unusual strides during the past few years is the use in solvents for nitrocellulose industries. While it is difficult to obtain a measure of this increase, some of its phases, such as artificial leather and lacquers, give an idea of its magnitude. There are many esters and solvents such as ethyl acetate, ethyl lactate, ethyl phthalate, ethyl propionate, and ansol solvents, which require the use of denatured alcohol and which have been used in increasingly large quantities.

The distribution of alcohol among the specially denatured formulas makes a very interesting study and shows trends in industrial development. Table II shows the production of some of the more important formulas of specially denatured alcohols.

Another outstanding development during the year is the pyroxylin lacquer industry. The U. S. Department of Commerce stated that the recent production of lacquers was as follows:

	Number of Establishments	Production in Gallons
Jan.-June, 1924	33	1,430,700
July-Dec., 1924	45	2,160,300
Jan.-June, 1925	67	4,880,200

It is estimated that during the second six months of the year the production exceeded 7,000,000 gal. This enormous increase in the production of lacquers has resulted in a very unusual demand for nitrocellulose and resin solvents. The production of butyl alcohol increased from 4,500,000 lb. in 1923 to 14,250,000 lb. in 1924. It is estimated that the 1925 production will represent a further increase of approximately 20 per cent. Prices were considerably lower during the year, making possible the substitution for other solvents. Butyl acetate production increased materially, and some of the manufacturers estimate a production of over 10,000,000 lb. in 1925.

TABLE I—PROGRESS IN THE PRODUCTION OF SOLVENTS, 1914–1925

	1914	1921	1922	1923	1924
Denatured alcohol, gal.**	10,404,976	22,388,825	33,345,748	57,565,143	67,687,296
Methanol, gal.*	....	....	6,808,911	8,593,727	6,897,589
Acetone, lb	10,425,817	4,380,100	....	8,742,805	....
Carbon tetrachloride, lb.	(about 10 million)		11,166,318	13,513,644	14,275,057
Chloroform, lb	1,333,954	944,303	....	1,805,083	1,301,492
Ether, lb	2,120,082	3,763,300	4,017,043	5,104,157	5,314,928
Ethyl acetate, lb	....	5,310,688	16,114,458	25,887,720	27,222,761
Amyl acetate, lb	1,315,730	636,000	1,692,074	3,207,022	1,514,123
Butyl Acetate, lb	....	....	2,467,506	1,816,086	7,095,662
			Estimated	Over	Approx.
Butyl alcohol, lb	....	2,000,000	4,000,000	4,613,396	14,250,062
Amyl alcohol, lb	....	112,384	....	1,130,000	....
Isopropyl alcohol, lb	....	....	256,868	....	....

* For 10 months of 1925 the Dept. of Commerce reports 5,838,000 gals.
** For the fiscal year ending June 30, 1925, the output was 81,808,273 gal.

The production of ethyl acetate did not maintain a rate of increase comparable to other lacquer solvents largely because of its reduced demand in the manufacture of artificial leather. The greater percentage of closed cars turned out by the automobile plants, and their use of materials other than artificial leather, accounts for this reduction.

The use of anhydrous alcohol and esters for lacquer purposes has proved to be quite successful and many thousands of gallons were used for this purpose during the year. The fact that removal of the water from such materials increases their solvent activity, has made possible many new and interesting combinations involving their use.

The production of amyl acetate decreased during 1924 and 1925, due largely to the substitution of butyl compounds. This substitution was made because of the uncertain supplies and high prices of the fusel oil and amyl acetate as compared with the increased production at lower prices of the butyl alcohol and esters.

A number of relatively new lacquer solvents have been used in substantial quantities during the year, but it is quite impossible to obtain any reliable information as to the quantities produced. Such materials as ethyl lactate, butyl propionate, butyl phthalate, and amyl phthalate are a few of those in this category.

The production of sulphuric ether seems to be increasing quite steadily. There is a stable demand for pharmaceutical and surgical purposes and the increase is apparently due to industrial requirements. There are a number of important solvent uses and ether for starting internal combustion engines during the cold weather is becoming quite important.

During 1924, the production of carbon tetrachloride amounted to 14,275,057 lb. Prices throughout 1925 were generally lower than the preceding year and this fact coupled with the increasing popularity of carbon tetrachloride mixtures for cleaning and fire-extinguisher purposes resulted in an estimated production of nearly 16,000,000 lb.

There are a number of solvents and some other alcohols which would be most interesting to consider but unfortunately there is no accurate data available so that a comparison of any value is impossible. One can only generalize by the statement that the year has been quite up to expectations from the standpoint of interesting and progressive changes. In most cases, if the rates of development maintained throughout 1925 are continued, 1926 will be a prosperous year in the chemical industry.

TABLE II—DISTRIBUTION IN GALLONS OF SPECIALLY DENATURED ALCOHOL BY MORE IMPORTANT FORMULAS

Formula	No. 1	No. 2B	No. 3A	No. 4	No. 13A	No. 18	No. 23A	No. 39A	No. 39B	No. 40
1913	2,839,021	....	59,165	511,330	471,111	166,890	....	....	....	....
1921	3,393,826	1,990,326	229,909	679,548	996,048	725,817	137,518	50,058	....	26,357
1922	4,994,241	2,450,939	540,771	898,948	1,780,771	1,036,893	466,832	1,330,091	1,425,543	321,975
1923	7,195,023	4,746,095	681,775	737,932	2,268,017	843,663	507,288	2,339,435	6,534,006	948,035
1924	7,067,676	5,242,882	811,295	779,275	1,902,536	1,716,284	460,016	2,085,014	7,356,764	1,817,191
1925	7,165,124	6,722,979	728,976	1,036,796	1,260,420	1,306,809	503,690	1,565,101	7,588,363	2,714,025

Lithopone Making Rapid Progress in Paint Industry

Zinc pigments finding increasing outlets in rubber, plastics, printing inks, pottery glazes, abrasives and oil cloth

By C. F. Beatty

The New Jersey Zinc Company, New York City

SALES and advertising have commanded Mr. Beatty's time and attention since his graduation from Amherst in 1912. He has been with the New Jersey Zinc Co. since 1918.

In addition to his position as advertising manager, he is also sales manager of the Master Painters Supply Co., a subsidiary. He represents his organization on the publicity committees of the National Paint, Oil & Varnish Assn., and the "Save the Surface" campaign. He is a director of the Assn. of National Advertisers.

ALTHOUGH there are many pigments made in whole or in part from zinc or zinc salts, there are but two of prime importance. This article will therefore be restricted to zinc oxide, which is sometimes known as zinc white, and to a newer pigment, lithopone.

Zinc oxide is produced by two different processes. The oldest method is known as the "French Process" or "Indirect Process." By this process, zinc oxide is made by vaporizing metallic zinc and burning this vapor to oxide of zinc. This product is extremely white, bright, and fine. In the other process—the "American Process" or "Direct Process"—zinc oxide is made direct from the ore. The furnaces differ, but the general principle is the same, except that the several reactions are performed almost simultaneously. The zinc is reduced from the ore, vaporized and oxidized in the same furnace. The product of this process is usually less bright and less white than that made by the French process, but it is equally permanent and almost as fine.

Zinc oxide finds its chief use in the manufacture of enamels and paints, and in rubber goods; but a variety of industries use it as a raw material. Some of the products in which the use of zinc oxide is general are as follows:

Paints and enamels	Glues
Rubber tires	Artificial ivory
Celluloid	Abrasive wheels
Insulated wire and cable	Dental cements
Druggists' supplies	Leather finishes
Printing inks	False teeth
Pottery glazes	Rubber boots and shoes
Glass	Table oil cloth
Discharge printing	Candles
Matches	

"French Process" zinc oxide is marketed under three brands, the product being classified according to its bulking properties, purity of color, brightness, and fineness of particle size. The "American" or "Direct Process" zinc oxides may be divided into two general groups, one of which is commercially lead-free, and the other containing from 5 per cent to 35 per cent basic lead sulphate. The commercially lead-free "American Process" zinc oxides are used chiefly in the manufacture of paint and both pneumatic and solid tires. Brands usually cover material especially adapted for use in particular industries and are graded according to uniformity of color and freedom from mechanical impurities. The "American Process" leaded brands are four in number and are used principally in certain grades of paint and pottery glazes.

Viewing the zinc oxide industry as a whole its production is shipped to the chief consuming industries about as follows:

Rubber	45 per cent
Paint	45 per cent
Miscellaneous	10 per cent

There are approximately 12 zinc oxide plants scattered throughout the United States, only one being equipped to manufacture all grades of this important raw material.

Zinc oxide is usually sold on f.o.b. plant basis with a freight allowance to destination, not in excess of 50c. per hundredweight on carload lots. In less carload lots, zinc oxide in these various grades may usually be obtained locally from warehouse stocks maintained by the more important producers. Zinc oxide is packed in barrels varying in size from 150 lb. for the light fluffy "White Seal" French Process zinc oxide to 400 lb. for the 35 per cent leaded grade. The more commonly used grades are packed in barrels containing 300 lb. The larger producers also have all grades, with the exception of "White Seal," packed in 50-lb. paper bags for shipment in carload lots.

The use of zinc oxide as an ingredient of rubber goods is largely standardized. It has been employed practically since the beginning of the industry. Pneumatic and truck tires, inner tubes and automotive accessories represent approximately 75 per cent of the whole industry, and by far the greater tonnage of zinc oxide is employed in the manufacture of these commodities. Zinc oxide is, nevertheless, an important constituent of other rubber goods such as mechanical rubber, rubber footwear, insulated wire and cable, and druggists' sundries.

Zinc oxide is probably the oldest reinforcing pigment employed in rubber. It imparts to rubber goods an increased tensile strength and resistance to abrasion and tear. It improves the aging properties by counteracting the tendency of all rubber goods to perish under the action of heat and light. Its high heat conductivity tends to prevent the local elevation of temperature in rubber goods which are subjected to extreme conditions of stress. This latter property tends to minimize

the danger of decomposition and is of particular importance in the production of a satisfactory solid tire. Zinc oxide serves as an activator or secondary accelerator for the several organic accelerating agents now generally employed in the industry. Many of these accelerators will not function in the absence of zinc oxide and others do not give optimum results. Zinc oxide also has the property of reducing the variability of different lots of crude rubber and is consequently an important factor in securing uniform products. Zinc oxide reduces the electrical resistance of rubber compounds less than any other pigment. It is for this reason that it is a constituent of practically all high grade insulating compounds. Rubber compounds with zinc oxide are soft and tacky in the uncured state, making it possible to secure the perfect adhesion of plies of stock built up in the manufacturing process. On account of the above properties, many of which are unique, zinc oxide may be characterized as an indispensable constituent of high grade rubber products.

Zinc Oxide Has Unusual Properties

It is in the manufacture of paint, however, that zinc oxide has made possible, along with lithopone, the most startling developments. A successful paint pigment should be extremely fine in particle size. In order to spread an even, uniformly smooth film with a brush, the paint must contain no particles large enough to be seen by the unaided eye. Zinc oxide is the finest of the paint pigments in common use. It is so fine that the highest power microscope must be used in order to see any of the outline of the individual pieces. It goes without argument that to be useful as a paint pigment the material must be insoluble in the vehicle with which it is mixed in preparing the paint or enamel. It must not change color when exposed to heat, light, cold, darkness, wind, rain, or the gases found in rather concentrated quantities about industrial centers. It seems hardly necessary to enlarge on this point, since any change in the pigment from any of the above causes will not only destroy the artistic effect of the coating, but will also under general circumstances, absolutely defeat the object of using paint.

Paint to be good paint must hide or obliterate the surface to which it is applied. The oil used has negligible hiding power, so it remains the duty of the pigment to do this. There are two factors to be considered. One is the hiding power or strength of a pigment, the other is the hiding power of the paint made from the pigments. These two are quite different; the first is a very great factor, though not the only factor influencing the second. The scientist is greatly concerned with the first, while the painter cares only for the second. Yet a strong hiding power paint cannot be produced with a poor hiding power pigment.

For exterior paints there must be enough vehicle to close the pores and make an even coating which will keep out as much moisture and air as possible. A good weather-resisting film is characterized by the degree of gloss possessed by the dried film. The longer this gloss can be maintained and the film kept unbroken the longer will be the life of the paint. To get these results a large quantity of vehicle and a generous quantity of pigment of fine particle size must be used. The pigments should have permanence, fineness and good opacity, as well as color and brightness. Zinc oxide possesses all these requirements. It has been used as a paint pigment for nearly 200 years.

Some years ago an extremely white paint pigment called lithopone came into more or less general use. It possessed many desirable characteristics, including, in addition to extreme whiteness, strong hiding power, moderate cost and easy working qualities, but it had the serious drawback of not being able to hold its whiteness in the presence of moisture or strong sunlight. The result was that its use was restricted to interiors.

However, the good features of the pigment were so outstanding that a large zinc producer put a corps of chemists at work to find the remedy for lithopone's susceptibility to light and dampness. About 5 years ago, after a long period of experimentation, the problem was solved and a pigment possessing all the good qualities of lithopone plus ability to hold its whiteness under all sorts of conditions was placed upon the market.

Briefly, lithopone is made by pouring together very pure solutions of barium sulphide and zinc sulphate. It is generally classified as a zinc pigment as it contains from 27 per cent to 30 per cent of zinc as zinc sulphide. In the mixture of liquids lithopone forms immediately as a combination of zinc sulphide barium sulphate. This white slime is then separated from the liquid, washed, filtered, muffled, washed again, wet ground fine, dried, and dry ground before packing. It is a dense white pigment and shows no reaction when exposed to sulphur or sulphur gases. It is whiter then either zinc oxide or white lead, is almost as fine as zinc oxide, and has greater hiding power.

Lithopone is not sold under any particular specifications, aside from that which the manufacturer may use for his own control, but is generally graded according to the use to which it is to be put. Its greatest application is in paints and enamels, but it also has a place in the manufacture of table oil cloth, rubber goods, the various kinds of linoleum, leather finishes, window shades and printing inks.

There are about 10 plants in the United States manufacturing lithopone. Many of the present lithopones —not all, nor even most, but many—are satisfactory for both interior and exterior painting. Lithopone is shipped in very much the same manner as zinc oxide. Stocks are carried by the larger producers in the chief consuming centers and the units are barrels containing 400-lb. or 50-lb. paper bags. Plant shipments are usually made in carload lots and prices are on a plant basis with freight up to 50c. allowed on carload lots.

High Lithopone Content Paint Feasible

In the past 8 or 10 years the lithopone production of the United States has increased enormously. It is reasonable to believe that in the future it will become a more and more important pigment. As an example of the advances being made in the application of this pigment, particularly in paint, a paint formula has recently been developed by a large producer, the pigment content of which consists of 40 per cent zinc oxide, 40 per cent of the particular producer's high-grade lithopone, and 20 per cent of inerts. This paint chalks gradually, as good paint should, it spreads well and it wears, although it contains no lead. These facts have been established beyond question through laboratory tests and actual use over a period of years. This paint is already being manufactured by an ever-increasing number of reputable companies and bids fair to become an ever-increasing outlet for lithopone.

Unstable Prices Characterize Ammonia Market

Increasing production of the synthetic products has unsettled the markets so long held steady under the group marketing plan

By E. M. Allen
Mathieson Alkali Works, New York City

GRADUATING from Purdue University in 1896 in mechanical engineering Mr. Allen worked first as a machinist with H. K. Porter Locomotive Co. and later as engineer of construction for the Cambria Steel Co.

The refractory business next claimed his attention and he became president of the Basic Brick Co. and the Fayette Mfg. Co. which were later absorbed into the Harbison - Walker Refractories Co. He then organized the American Refractories Co. in 1906, and in 1909 initiated and organized the Austro American Magnesite Works in Austria.

His presidency of the Mathieson Alkali Works dates from 1919.

THE marketing of ammonia and ammonium compounds is a phase of our Nation's business which has an important and far-reaching influence on many of our basic industries. Sulphate of ammonia, aqua ammonia, anhydrous ammonia, sal ammoniac or ammonium chloride, ammonium bicarbonate and carbonate are the forms in which ammonia is produced and merchandised in greatest volume. Some of the other salts, such as ammonia alum, and the nitrate, phosphate and perchlorate are important for special uses and are used in moderate quantities.

Prior to 1920, practically all of the ammonia consumed in this country was of byproduct origin. Since that time synthetic processes for the production of ammonia have been gaining and the outstanding development during 1925 has been the remarkable degree of success achieved by the synthetic processes, which are now turning out appreciable amounts.

The estimated quantity of ammonia available in the United States in 1924 and the manner in which it was distributed are shown in Table I. When statistics for 1925 are officially compiled, the most important change will be in the quantity of ammonia produced synthetically and listed in the above classification as air nitrogen. Any changes in the production of byproduct ammonia will depend almost entirely on the normal expansion of coke production, in byproduct equipment. It is estimated that about 80 per cent of the coke produced in the United States is now made in byproduct coke ovens.

Table I—Ammonia Production and Distribution in the United States in 1924

Sources	Tons of Nitrogen	Tons of Ammonia
Coke ovens	109,000	132,300
Gas works	5,500	6,700
Bone distilation	200	240
Air nitrogen	3,500	4,250
Imported as sulphate	1,200	1,460
Total	119,400	144,950
Disposition		
In mixed fertilizers	46,000	55,800
Direct as fertilizer	2,000	2,400
Anhydrous ammonia	13,500	16,400
Aqua ammonia	22,000	26,700
Ammonium salts	5,000	6,050
Explosives	7,000	8,500
Exported as sulphate	24,000	29,100
Total	119,400	144,950

A definite trend is, however, evident in the increased use of manufactured coal gas and the latest developments in fuel coke and gas supply indicate that an increasing amount of byproduct ammonia will result from the increased use of manufactured gas. The original broad distinction between the coke and gas industries is rapidly disappearing and it will not be long before the two industries will become recognized as almost identical. A number of synthetic ammonia plants are now successfully operating. Increases in the capacity of existing plants and the completion of plants now under construction will give the United States an estimated capacity of 25,000 tons of synthetic ammonia by the end of 1926.

Because of the fact that synthetic ammonia is a product of exceptional purity and requires practically no additional refining and purification, it will undoubtedly displace byproduct ammonia in those industries where purity of the finished product is essential. Inasmuch as synthetic ammonia is produced directly as an anhydrous liquefied gas, it will almost completely replace byproduct ammonia in the manufacture of anhydrous ammonia for refrigeration. All but one of the larger national distributors of anhydrous ammonia have arranged to supply the synthetic product and before the end of 1926, this industry will be almost completely converted to a synthetic source of supply. In the manufacture of aqua ammonia, the synthetic product has already made important progress in displacing the byproduct material and eventually, as production increases, the excess will find an outlet as sulphate of ammonia and other cheaper compounds.

This situation again brings out the necessity of the very liberal depreciation that all chemical companies should use, in view of the possible new discoveries completely ruining a well established industry.

The principal centers of production of byproduct ammonia will be determined by the expansion of the use of metallurgical coke in the iron industries and by the adoption of modern methods for manufacturing coal gas in the principal centers of population and eventually at the coal mines. This ammonia will probably be almost entirely consumed in the production of sulphate of ammonia or other forms of fertilizer and this situation should be forcibly driven into the public view to offset the uneconomic ideas of certain elements that are considering the Muscle Shoals proposition.

In the manufacture of anhydrous ammonia, there has already been a very marked shifting in the centers of production. Prior to 1920, St. Louis, Chicago, and Philadelphia were the principal manufacturing points. Chicago has already been completely eliminated as a producing point, St. Louis partially so, and before the end of 1926, the manufacture of anhydrous ammonia will be almost completely transferred to the principal seats of the synthetic industry, namely, Niagara Falls, N. Y., Syracuse, N. Y., South Charleston, W. Va., and the Pacific Coast. With these radical changes in the location of production points, there will be permanent changes in the delivered price of anhydrous ammonia to the consumer, due to the natural effect of transportation expense. The cost of selling and distributing ammonia is very high, so that the competitive situation is bound to cause a radical change in the selling and distribution methods. This part of the business is lost sight of by the self-appointed experts in and also out of the Government's employ, whose experience is more or less theoretical, to say the least.

Because of the fact that a large proportion of the byproduct ammonia made in the United States has been marketed through a central selling agency, prices of ammonia and ammonium compounds have been very uniform over a considerable period of time. The principal outlet for ammonia has been sulphate of ammonia consumed in the fertilizer industry. The price of this material has been determined by competition with Chilean nitrate of soda as a competitive nitrogenous fertilizer material. The Chilean Nitrate Producers Association fixes the price of Chilean nitrate and with this price stabilized and known in advance, the price of sulphate of ammonia naturally follows according to the comparative nitrogen content and the supply and demand of the two products.

During the past year, an unusual competitive situation has developed. Some of the important factors in the production of synthetic ammonia are not interested in the central selling agency previously mentioned, and have marketed their ammonia independently. The result has been a series of price changes that have depressed prices on anhydrous and aqua ammonia over fifty per cent of their former level, and have also affected to a less marked extent the prices of other ammonia compounds. The ultimate result is very much in doubt and cannot be predicted at this time. It is evident to executives who get real and not theoretical costs, that present prices of anhydrous and aqua ammonia are not profitable, due principally to the high cost of present methods of distribution. If the present low prices continue, it will be necessary to decrease the cost of distribution, which can only be done to the detriment of service to the consumer. It is also possible that the low prices will effect the prices of sulphate of ammonia and nitrate of soda, resulting in cheaper fertilizer. This in turn must depress the value of animal fertilizer materials such as dried blood, tankage, etc. With lower prices for packing-house byproducts, the value of live stock will be affected and there is no telling where the cycle would end. It is hoped that after the new products are introduced and become established in their logical markets, that stabilization of prices will follow. In this connection, the experience of England and Germany and some other foreign countries may serve as a valuable guide. Synthetic ammonia plants have been subsidized by some of these foreign governments and encouraged as new national resources of importance to military preparedness.

As far as foreign competition for American consumption is concerned, there is very little cause for apprehension. Practically no anhydrous or aqua ammonia is imported into the United States, and present imports of sal ammoniac, ammonium bicarbonate and bicarbonate seem to balance our own production. Some sulphate is imported, but our exports of sulphate are considerable and greatly outweigh the imports.

The excess of exports over imports amounts to about 28,000 tons of ammonia. A very large proportion of this is exported as sulphate, but about 1,000 tons per year are exported as anhydrous. Due to intense local competition, all leading brands of anhydrous ammonia have been developed to a higher degree of purity than most of the foreign brands. American container equipment is also superior, so our prospects of retaining our position in the anhydrous field appear to be satisfactory for the time being. It is probable that greater competition will develop in the world's markets for sulphate. Some countries, whose reserves and supplies of coal are limited, are encouraging the development of synthetic ammonia industries. Government subsidies are also certain to exert an effect on export markets. There have been some improvements in the quality of foreign sulphate that must be recognized and met. For years sulphate has been sold on a standard of 25 per cent NH_3. An improved product, dry and free from acid so that it will not rot the bags, and containing 25.5 per cent of ammonia, is becoming more important to the export trade. Ammonia made synthetically is especially adaptable for the preparation of a product of this new specification.

Taken as a whole, the ammonia situation during 1925 has been satisfactory. Prospects for 1926 are excellent. The increasing recognition of the importance of soil fertility, the normal increases in acreage under cultivation, the steady development of artificial refrigeration, the almost universal use of radio, with its increased outlet for sal ammoniac in dry batteries, and the many other factors that will be favorably affected by any period of prosperity, indicate that during 1926 there should be logical solutions of the present troublesome problems in the marketing of ammonia and its compounds, but as matters stand today, there is no incentive for consideration of any additional capacity, until the consumption takes up the excessive over-production.

Progress of Synthetic Ammonia Industry

According to the most recent information from government sources, there were at the close of 1925, eight direct synthetic ammonia plants in existence or about to operate. Four of these were of small size, each with a capacity of 1 to 3 tons of ammonia per day. The other 4 vary in capacity from 10 to 27 tons of ammonia produced per day.

The total estimated capacity now installed is 86 tons of ammonia daily, but probably not over 70 tons per day will be produced at any time during 1926, and the average will doubtless be nearer 60 tons. During 1926, one can, therefore, anticipate about 22,000 tons production from these synthetic plants. This figure can be compared with the figures for 1925, during which year five plants produced significant amounts of ammonia, totalling 13,140 tons.

Higher Import Duties Have Affected Vegetable Oil Industry

Decline in imports of oils dates from time new tariff went into effect with similar result on cotton oil exports

By Martin F. Austin
W. R. Grace & Co., New York City

THE AUTHORITY with which Mr. Austin writes on this subject is found in his 13 years experience. Starting as a trader on the N. Y. Produce Exchange, he later had charge of the commodity departments of Shearson Hammill & Co., handling cottonseed and imported vegetable oils.

He was then successively in charge of the Western business and the import department of J. C. Francesconi & Co., dealing in oils, fats and waxes. Finally he headed the vegetable oil department of W. R. Grace & Co.

In 1921 he was chairman of a joint committee of the N. Y. Produce Exchange, Interstate Cottonseed Crushers Assn. and Foreign Commerce Assn. of the Pacific Coast to formulate sales to govern trading in vegetable oils and waxes. For five years he has been on the Oils, Fats and Wax committee of the N. Y. Produce Exchange.

IN ORDER to appreciate the importance of the domestic vegetable oil industry, it might be well to remember that the census report of 1923 showed the value of vegetable oil products to be in excess of $1,000,000,000. Values for the current year will be about the same as in 1923. In order to show the volume of business, imports of the principal vegetable oils in several years, and the volume of production of domestic oils in 1924 and the first 9 months of 1925 are given in the accompanying tables.

There has been an important shrinkage in the volume of imports of most of these oils commencing with 1922, the date on which our present prohibitory tariff became effective. In addition to our loss of import commerce, our exports of cottonseed oil have practically ceased.

Cottonseed oil is expressed from seeds of the cotton plant and is a product here of American cotton but also produced in Europe from Egyptian and Indian cotton. As many as 800 establishments were at one time engaged in crushing these seeds regarded as a menace a generation ago. Consolidations and failures have greatly reduced the number of crushing plants. A quantity of 1,500 lb. of seed cotton contains about 500 lb. of lint cotton and 1,000 lb. seed. The seed first is delinted which results in a very short staple called linters. The seed is then decorticated or hulled. In Europe, however, the undecorticated seeds are crushed and the "fuzzy" varieties of seed produce a cake detrimental to cattle feeding. Our cake is, therefore, more valuable as a stock feed. From 1,000 lb. seed is produced about 300 lb. crude oil, which with a refining loss averaging about 10 per cent produces an edible oil used for margarine, cooking, salads, mayonnaise, and compound lard. The crude oil is used for making soaps, washing powder, as a burning oil, etc. Winter oil is made by removing the stearine so that it remains fluid even at low temperature. The latter is the salad grade and is sold under fancy "table oil" brands.

Crude oil is sold very much in the same manner as other vegetable oils, with several grades specified, such as choice crude, prime crude, basis prime crude, and off crude, specifications of which are definitely stated by the associations in each individual state of the cotton producing belt but more frequently under the rules of the Interstate Cottonseed Crushers Association, a national organization which most of the mills have joined. Most of the trading is done on basis prime crude which permits the oil to be delivered on contract without the right of rejection even if it does not produce prime summer yellow refined oil, unless it refines to a color darker than 35 yellow 16 red.

DOMESTIC PRODUCTION OF VEGETABLE OILS

	1924	1925 9 Mos. End. Sept.
Peanut oil, lb.	6,631,244	11,329,306
Corn oil, lb.	116,864,953	73,517,279
Cotton oil, lb.	1,152,782,652	815,654,937
Linseed oil, lb.	705,585,985	541,854,053
Castor oil, lb.	37,433,650	....
Soya bean oil, lb.	950,437	961,793
Cocoanut oil, lb.	192,176,634	143,186,331
Olive oil (edible), lb.	1,503,662	37,189

The refined oils are described as prime summer yellow which requires an oil to be not darker than 35 yellow 7.6 red and not lighter than 35 yellow 3.5 red; and not more than ¼ of 1 per cent free fatty acids. Prime winter yellow shall not be darker than 35 yellow 3.5 red, not lighter than 20 yellow 2.5 red, not more than ¼ of 1 per cent free fatty acids and must stand limpid at certain temperatures according to the test or rules of the association under which the sale is made. There are several other grades which are clearly defined by the rules of the various associations governing these trades.

There is a continuous daily open market on the New York Produce Exchange from 10:45 a.m. until 2:45 p.m. where sales and purchases may be made for 8 months forward. On this market, contract provides for deliveries in lots of 100 bbl., the barrels to contain approximately 375 lb. and regulations are prescribed for the tendering, receiving and settlement of oil. This is best described as a futures market, and the broker members of the Exchange doing business in this market are governed by the Rules of the New York Produce Exchange, stipulating requirements for margins, financing, settlements, etc. It provides a medium for purchases and sales many months in advance of actual delivery and is used as a "hedge" market by both the buyer and the seller. Sales for future delivery in this market aggregated 5,000,000 bbl. in 1924, also in 1925.

The residue from cottonseed crushing and oil refin-

IMPORTS OF VEGETABLE OILS INTO THE UNITED STATES

	1914	1919	1922	1923	1924	1925 (10 Mos.)
China wood, lb	36,590,730	46,639,177	55,571,790	87,291,675	81,587,854	84,639,163
Cocoanut, lb	74,588,195	347,200,288	213,344,572	180,699,829	222,665,376	181,813,251
Palm, lb	61,753,482	19,280,762	39,159,342	128,494,679	101,779,802	105,746,381
Palm kernel, lb	30,588,958	1,945,345	2,489,490	....	4,747,597	42,901,827
Rapeseed, gal	1,463,099	2,091,052	1,351,827	2,124,330	2,314,944	1,438,823
Linseed, lb	1,409,497	7,181,797	168,478,882	43,096,714	13,247,190	11,915,254
Soya bean, lb	16,363,645	244,104,805	3,804,130	41,679,110	9,125,158	17,546,900
Peanut, lb	9,990,810	85,452,112	2,818,642	8,008,622	15,394,836	2,426,340
Copra, lb	44,459,158	300,965,246	255,721,818	332,974,498	285,429,953	269,900,038

ing such as soap stock, cake, meal hulls, and linters are sold under the rules of the Interstate Cottonseed Crushers Association, or one of the individual state associations. The crude oils and residue from refining known as soap stock, are sold and moved almost entirely in tankcars furnished by the buyers. The edible grades move partly in tankcars, but mostly in barrels.

Formerly as much as 700,000 bbl. per year were exported to Europe, but since the advent of our present high tariff on soya bean oil, cocoanut oil, peanut oil, olive oil, etc., we have practically lost our European export trade, as these countries can purchase almost at their own price, without our competitive buying of miscellaneous oils referred to, and thus get along without our cottonseed oil.

During 1923 the high price point per lb. was 10¾c., low point 8¾c.; 1924 high point 12c., low point 7⅞c. During 1919 oil sold as high as 27½c., all basis prime summer yellow refined in 100 bbl. lots, New York. The basis prime crude grade in tankcars averages 1½c. to 2c. per lb. lower f.o.b. producing mills.

Peanut Oil

Peanut oil here is known elsewhere as arachis oil, ground nut oil and earthnut oil and forms about 50 per cent of the contents of the kernels of nuts bearing similar names grown in the warmer climates of Europe, Asia, Africa, North and South America. Here our limited production is now grossly inadequate to supply the demands of the confectionery and salted nut trade, and our production of oil has diminished almost to the vanishing point as the confectionery trade is able to outbid oil manufacturers in the purchase of the nuts. On account of our commercially unwise tariff of 4c. per lb. on the oil and same rate on the shelled nuts we are limited to the inadequate production of a small area in the South. The nuts are shelled by special machinery, the red inner skin removed by a blast of air and the kernels are then subjected to hydraulic pressure to remove the oil. The cake is pressed again, and then again with the inner or red skin, resulting in first a virgin cold pressed oil, and secondary grades thereafter, and the cake the finest of stock feed on account of highest protein value of all oil cakes. The first grade of oil makes the finest salad oil and an important ingredient of "nut butter," margarine, the second grade a good cooking and edible oil and the lower grades chiefly used for soap making. Production of peanuts in the U. S. in 1924 was 600,000,000 lb. from which only 6,631,000 lb. of oil was produced.

Sales are made usually by brokers identified with the cottonseed oil trade and when described as fair average quality, it must be filtered or well settled, maximum 2 per cent free fatty acids, and ½ of 1 per cent moisture and impurities, provided, however, that oil containing free fatty acids not exceeding 5 per cent and moisture and impurities not more than 1 per cent shall be accepted on contract with an allowance of 1½ per cent of contract price for each 1 per cent free fatty acids in excess of 2 per cent and an allowance for moisture and impurities over ½ of 1 per cent in accordance with the usual regulations. When oil is sold guaranteed prime, it must produce prime refined yellow oil with a refining loss not exceeding 5 per cent, provided that an oil which produces prime refined yellow oil with a refining loss greater than 5 per cent shall be accepted on contract with an allowance to the buyer. Refined edible deodorized peanut oil shall not exceed ⅒ of 1 per cent free fatty acids and when sold as white shall not be darker than the combined standard glasses of 12 yellow 1.5 red; when sold as yellow shall not be darker than 30 yellow 3 red.

During the year 1923 the high point was 15½c., low point 12c.; 1924 high point 13c., low point 11¼c. During the year 1916 oil sold from 12½c. to 14c.; during the year 1919 as high as 21c. per lb., all basis tankcars at Southern mills.

The Oriental crude filtered peanut oil is usually sold on descriptive terms similar to domestic crude and this grade sold in 1923 at the high point at 10½c., low point 8½c.; 1924 high point 9¼c., low point 8¼c. During the year 1918 oil sold as high as 18½c. and in 1919 as high as 26½c., all basis sellers tankcars Pacific Coast port of entry. Prior to 1922 the duty was ⅜c. per pound.

Corn Oil

Corn oil or maize oil, is obtained from the germs of corn kernels and these germs are recovered in the process of manufacturing starch and glucose. Formerly it was a by-product of alcohol distilleries. The crude is used mainly in making soft soaps, and cleansing specialties, also in rubber substitutes. The refined is used for edible purposes, in cooking, and for salad oils, the making of mayonnaise dressings. This is chiefly a United States product.

Most of the crude oil is sold on standard quality maximum 3 per cent free fatty acids maximum ½ of 1 per cent moisture and impurities, provided, however, that oil containing not more than 5 per cent free fatty acids and moisture and impurities not exceeding 1 per cent shall be considered good delivery with the usual allowance to the buyer for excess of free fatty acids and moisture and impurities. Most of this grade moves in tankcars although there is a limited volume of business in barrels.

There is a very considerable business in refined edible deodorized corn oil, quality guaranteed by manufacturer not to exceed ⅒ of 1 per cent free fatty acids, free from moisture and impurities, clear and brilliant, sweet and neutral in flavor and odor, and not darker than the combined standard glasses of 35 yellow 7.6 red on Lovibond's tintometer. This oil is sold by the manufacturers direct, and also through the medium of brokers. During the year 1923 the high point was 12½c., low point 9¾c.; 1924 high point 14¼c., low point 10c. During the year 1915 oil sold as low as 7¾c. per

lb.; and the year 1924 as high as 20¾c. per lb., all basis carloads, bbl., New York.

SESAME OIL

Sesame oil is produced from white and dark sesame seed grown largely in The Levant, Egypt, India and China, averaging nearly 50 per cent oil content. The admixture of sesame oil to margarine is obligatory in certain Continental European countries. The first cold pressing produces an exquisite edible oil used for cooking, salad oils, margarine, etc., while the second and third pressings result in an excellent soapmaking oil and cake, good for cattle food. This oil is subject to adulteration with edible rapeseed oil in Continental Europe. When our cotton oil and peanut oil production is small and prices high sesame oil is more sought after and we are obliged to bid against Continental Europe to obtain supplies. Not much crude comes here; it is sold as refined edible deodorized, natural unbleached yellow, ordinary white maximum 20 yellow 2½ red, and white, maximum 10 yellow 1 red, imported in barrels and drums.

Not much sesame oil is produced in the United States even from imported seed. Most of the oil is imported by merchants who sell to large distributors and they in turn arrange for final sale, through their local organizations, to the smaller users. During the year 1923 the high point was 16½c. per lb., low point 11½c.; 1924 high point 15c., low point 10½c. Prior to this time, prices were quoted in gal. During the year 1911 oil sold as low as 75c. per gal.; and the year 1918 as high as $4 per gal. of 7½ lb.

PALM OIL

Palm oil is obtained from the fruit of the palm tree on the West Coast of Africa and now reaching the stage of commercial production in Sumatra. Two main crops, and in some regions four or five, are gathered each year. The oil is obtained from the outside or fleshy portion of the ripe fruit which is cut in bunches by natives and allowed to fall to the ground, thus bruising the fruit which leads to rapid fermentation. The fruit is then picked from the bunches and placed in a hole dug in the ground and lined with leaves where it is left for several weeks to soften the fruit for removal of the kernel or palm nut. The fermented fruit is beaten into a pulpy mass from which the oil is squeezed and drained into a cemented hole. The remaining pulp is boiled in water and further oil is removed from the top. This crude hand product is carried to the nearest station where traders collect it and send it down the river to market. Some slight improvement in method is being made with the introduction of portable machinery but no large central mills seem to be practical.

From 2,000 to 5,000 bunches of fruit weighing from 20 to 40 lb. are required to produce one ton of oil, and two tons of kernels will be simultaneously obtained. Laboratory experiments have shown this to be only one third the maximum oil yield obtainable, the percentage of oil varying from 14 per cent to 30 per cent according to locality.

The oil is sold on description as to origin such as: "Hards": Niger, Brass, New Calabar. "Mediums": Port Harcourt, Forcados, Lome. "Softs": Lagos, Bonny, Old Calabar, Opobo; the free fatty acids of the hards being high, and of the softs being low. Color ranges from orange yellow to dark red, and bleaches by exposure to the air, by heating and by chemicals.

The oil is used when fresh as a cooking fat by the natives in Africa, but owing to the crude methods of production it has upwards of 10 per cent free fatty acids when shipped and this runs as high as 50 per cent at destination on some grades.

The soft oils are obtained from the freshest or most carefully prepared fruit and contain a lower percentage of free fatty acids than the hard oils which are obtained from the more fermented fruits. Palm Oils are hardly susceptible to adulteration with other oils, are easily identifiable, except as to origin in which misrepresentation may be practiced. Principal use is in making soaps and candles and in dipping tin plate. In the past few years it has been found refinable and while it does not bleach out entirely white, it has found favor at a low price in the manufacture of compound lard and cooking fats.

During 1923 the high point was 8¾c., low point 6¾c.; 1924 high point 10c., low point 7c. During 1913 the oil sold as low as 7¾c., and in 1918 as high as 40c., all Lagos grade price per lb., basis casks, carloads New York.

OLIVE OIL

Olive Oil is produced from the fruits of the olive tree, which is abundant in countries bordering on the Mediterranean Sea, in Greece, Italy, Spain, France, Portugal, in Syria, Algeria and Tunis, and to a lesser extent in California.

The olives are gathered just before maturity for the best grades and the greatest yields. The oil content of ripe olives is said to be as high as 70 per cent but it would be difficult to obtain fully ripe olives in quantity and press them quickly enough to attain this maximum, so the practical results vary from 40 to 60 per cent except in California where it is as low as 15 to 30 per cent. Great difficulty exists in obtaining the fruit and pressing it at the most favorable time to avoid fermentation. Hand picked fruit naturally yields the choicest oil. Opinions differ as to the advantages of peeling before pressing, and methods vary greatly in different localities. Authorities do agree on the first pressing or "Virgin Oil" being the best for edible use, and this is followed by a second and third process for the less valuable grades, until a technical or commercial grade is obtained for the making of castile soap, for burning, and lubricating purposes.

The cake or pulp, called sanza, is subjected to treatment by carbon bisulphide and we then have a product known as sulphur oil, improperly described in our trade as olive oil foots, of a deep green color, containing from 15 to 60 per cent free fatty acids. This is used all over the world in the manufacture of green soaps for toilet and textile use. Such a soap is vitally necessary in some of the textile trades. Nearly one half of the total imports of this latter material is consumed by two important American toilet soap makers by whom it is imported in steamer tank compartments of 600 to 800 tons capacity. The remainder enters the country in barrels and is distributed throughout the year to smaller consumers.

California production does not begin to satisfy home requirements; production is not increasing and in price, it does not compete with the foreign product which carries the heavy duty of 6½c. per lb. in bbl. and 7½c.

per lb. in cans, including oil and containers when weighing. The California quality also leaves much to be desired. Blending of oils from various localities is considered necessary to produce attractive taste and to maintain uniform quality of well-established brands. The high price naturally lends to the oil general suspicion of adulteration with less costly oils, such as cotton seed, soya, peanut, sesame, etc.

Cocoanut Oil

Cocoanut oil is obtained from the meat of cocoanuts which grow on all coasts and islands of the tropics but grow best on or near coast at low altitudes. Trees grow inland but do not bear cocoanuts, nor do they bear nuts in subtropical climates.

Cochin cocoanut oil reputed the finest and whitest originally produced on the cost of Malabar from fresh kernels and now similarly produced in other localities, retains the name of Cochin type.

Ceylon cocoanut oil came originally from Ceylon but here climatic conditions, especially that of more moisture, do not favor the sun drying of the meat hence the oil, not so white as Cochin and greater rancidity of the dry meat causes higher free fatty acids. Copra oil in Europe and cocoanut oil in the United States are produced from the dried meats which are shipped from sources of cocoanut production. Java also produces a grade between Cochin and Ceylon.

Modern necessity brought about the quicker means of drying copra in kilns because of frequent showers making it impossible to produce sundried in large quantities. Copra — or dried cocoanut meats — contains approximately 65 per cent oil or fat, and when stored in "godowns" at shipping centers of producing countries, as much as 10 per cent water, which is gradually reduced as it drys out. The oil is obtained by pressure, and expeller methods, usually a combination of both. The American made Anderson expeller is quite generally employed and the remaining cake makes excellent cattle feed. When oil is obtained by solvents the remaining cake is unfit for cattle food.

Cocoanut oil enters into the production of soap (especially toilet and shaving soaps) nut butters, compound lard, blanching of peanuts, in confectionery, etc. In some of these uses it is necessary to refine and even hydrogenate or harden it, whereas in soap, the crude is used and it is very largely saponifiable.

In the United States the consumption in edible channels is about [illegible] per cent while technical and industrial use consumes the remaining 75 or 80 per cent. In western Europe 60 per cent of their 900,000,000 lb. goes into edible channels and 40 per cent into technical uses.

Sales of cocoanut oil are made usually well in advance of delivery date on standard rules and contract of the New York Produce Exchange which definitely sets forth the rights of both buyer and seller. As a rule, sales are made for a definite number of tankcars for shipment in specified months from Pacific Coast or Atlantic Coast.

Manila cocoanut oil description means produced in Manila. Contract is basis 5 per cent maximum 7 per cent free fatty acids. This means that if the free fatty acids proved by public chemist's test to be more than 5 per cent, an allowance is made to the buyer of ½ of 1 per cent of the contract price for each 1 per cent or fraction higher than 5 per cent; if the free fatty acids are less than 5 per cent, the buyer pays the seller a similar allowance over and above the contract price.

The product of domestic mills is sold on similar contracts with slightly different descriptions according to the characteristics of the product of the different mills. Both the Manila and domestic mill production of cocoanut oil come under the Ceylon type of oil.

Cochin type shall not contain more than 3 per cent free fatty acids and shall have a color not deeper than 12 yellow 2 red, which is usually determined by Lovibond's tintometer.

Refined edible deodorized cocoanut oil must be free from moisture and impurities, sweet and neutral in flavor and odor and not in excess of 1/10 of 1 per cent free fatty acids. Color not darker than 12 yellow 2 red.

Many sales are made direct by producers to the consumers but the usual means is though the medium of brokers who are compensated by the sellers at the rate of 6c. per 100 lb. on each sale made.

Formerly the oil was imported in comparatively small quantities, packed in barrels, pipes, hogsheads, etc., but this method is rapidly losing ground, and the quantities of crude oil now handled in barrels are limited, although a great deal of the refined oil trade still is handled in barrels. Nut butter, and compound lard manufacturers purchase a certain proportion of their cocoanut oil hydrogenated or hardened to whatever degree is best suited to their requirements.

Copra is duty free. Cocoanut oil under present tariff is subject to duty of 2c. per lb. except from U. S. territorial possessions.

Castor Oil

Castor oil is obtained from the beans or seed of a plant found in India, Paraguay, Mexico, Brazil and Argentine. Although energetic efforts were made to cultivate this plant in Florida during the world war, with government aid, the results were not profitable. Some beans are obtained in our southwestern states. Castor seed contain from 40 to 50 per cent oil, obtained by expression and extraction methods. Medicinal grades are obtained in the first or cold pressing which is followed by a second and third operation for the commercial grades. The cake is poisonous and used only for fertilizer. The free fatty acid content of castor oil is notably low; specific gravity and viscosity the highest of any known fatty oils. The commercial use is in the making of turkey red oils, very fine toilet soaps (especially transparent soaps) as a lubricant (especially in marine engines and aeroplane engines) for leather preservatives, sticky fly-papers, etc.

Imported castor beans or seed are subject to duty of ½c. per lb. and the oil 3c. per lb., practically prohibiting the importation of oil, although we must, of necessity, import the largest part of the seed we crush. Domestic production is sold as medicinal, U. S. pharmaceutical, and some manufacturers also sell a No. 1 grade of the same quality. A lower grade, resultant of second pressings, is sold as No. 3.

During 1923 the high point was 14½c., low point 12½c.; 1924 high point 17c., low point 15c. During 1913 oil sold as low as 9½c., 1918 as high as 30c. per lb., all for medicinal grade in bbl. New York. Industrial or No. 3 grade sells on an average of ½ to 1c. per lb. lower.

Editor's note: Marketing of other vegetable oils will be discussed by Mr. Austin in a subsequent issue

Larger Exports and Lower Prices Characterize Dye Markets

Organic chemical industry in general has made forward strides; rubber accelerators, flotations reagents, as well as dyes find greater use

By J. Warren Kinsman
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FOLLOWING his education at Wesleyan and Columbia universities, the author of this article entered the employ of the duPont company, and since 1915 has held positions in various departments of that large and varied organization.

Chemical products, Fabrikoid, smokeless powder and dyes have claimed his attention.

For the dye industry he has served on important committees of the American Dyes Institute, Synthetic Organic Chemical Manufacturers Assn., American Chemical Society and National Research Council.

THE organic chemical industry, as established since the start of the World War, has rounded out its tenth year with a record for achievement rarely paralleled in commercial history. Having accomplished, prior to the past year, the major purposes of supplying all of the bulk colors and the principal specialties needed by American consumers, domestic manufacturers settled down to the serious problem of filling the few remaining gaps in the varieties desired and of still further improving the quality of those already in use. Actuated by the demands of an appreciative public, there has been a tremendous trend toward the use of faster and more permanent colors in textiles and all other types of dyed materials, to which need the producers of synthetic chemicals have responded with their characteristic resourcefulness. While the volume of dye business in 1925 was doubtless larger than in the previous twelve months, the most severe competition from both domestic and foreign sources that the industry has so far experienced was the cause of a serious decline in prices. As a consequence the revenues of the industry are much reduced as compared to 1924.

One effect of the automatic reduction in the tariff rates during September, 1924, was an advance in the quantity of colors imported to approximately five million pounds, virtually double those of the previous year. The products from abroad continue to comprise the most expensive types, such as the vats, alizarine and developed dyes, as well as those which existing patents prevent being made in the United States. It is roughly estimated that, of the imports, probably 55 per cent originated in Germany and 31 per cent in Switzerland, whose quota has increased substantially in sharp contrast to her pre-war position, while the remaining came from England, France, Italy, Belgium and Holland, with a possibility of some of the shipments from the latter three countries also being of German manufacture.

The so-called dye and chemical provisions of the Tariff Act have been most ably administered by the Treasury Department and the Department of Justice. In all litigation attacking this legislation, which has ranged from a questioning of the constitutionality of the entire act to technicalities concerning the construction and interpretation of its language, the Federal Government has been singularly successful in winning, against the able and resourceful opposition of the importers, opinions in the Customs Courts favorable to the domestic industry.

Exports Increase

Despite the fact that America's exports of dyes and intermediates increased 50 per cent during the first eleven months of 1925 over the 16,500,000 pounds for the corresponding period of 1924, the value rose only 16 per cent to about $6,500,000. Among the several causes for this changed relationship between quantity and value, the two most important are the rapid decline in selling prices under pressure of bitter competition by all producing nations in the few remaining open markets of the world and the greatly increased proportion of low priced commodities such as indigo, sulphur blacks and tonnage direct colors. As usual the bulk of America's export trade was conducted with China, India and Japan, the latter importing particularly heavy supplies during the early months of 1925. with smaller deliveries to Canada, Mexico, South America, Java and Spain. For the first time Russia became an important buyer and a large prospective user of American dyes as her great textile industry resumed production at a rate approaching 70 per cent of its pre-war capacity.

Japan's enactment of an embargo against German dyes was the result of extraordinarily heavy imports, that were regarded as dumping, and was her most recent act toward assuring the success of her government fostered and subsidized organic chemical industry. But this exclusion is viewed as only a temporary measure since it seems inevitable, especially as no other dye producing country is so discriminated against, that a mutually satisfactory method of controlling German imports will be negotiated by Japan, much of whose industry, educational system and institutions are patterned after German methods. Meanwhile, sales of German dyes and chemicals in Japan continue at the usual rates because the restrictions were anticipated sufficiently far in advance to land adequate supplies for two or three years' normal business.

The German manufacturers improved their position

in the domestic market by alliance with several American firms having already available large manufacturing plants, much in the same manner as the Swiss group established itself in the United States several years ago. By this means, the American manufacturers concerned will have the benefit of the highly developed German manufacturing knowledge and experience while the foreign interests will acquire a portion of the domestic trade which the Tariff Act of 1922 has heretofore prevented.

Elimination of Colors Needed

No more important work remains for the dyestuffs industry than that which has occupied so much attention from the present administration of the Department of Commerce. It seems that commercially profitable success can follow the accomplished scientific and technical success only if manufacturing methods are made more efficient by eliminating a majority of the present varieties of colors, now numbered in the thousands, and standardizing on the essential types, in the same manner as the paint industry several years ago reduced their shades and tints from several hundred to about thirty or forty. Within recent memory, the steel, electrical, hardware, glass, ceramics, lumber, paper and textile industries have gained enormous economic advantages by discontinuing the multitudinous classes of articles for which only a limited or specialized sale exists and standardizing upon a limited number of products which can be utilized for the great majority of all needs. Obviously their success is a guide-post toward greater prosperity for the chemical manufacturer.

As a means of logical expansion, where their existing manufacturing facilities, technical personnel and sources of raw material may be employed to still greater advantage, several dyestuffs producers have engaged in the preparation of organic chemicals for the rubber, mining, photographic, agricultural and automotive trades. From the viewpoints of quantity and value, not to mention their inestimable worth in making possible far superior finished products, rubber vulcanization accelerators are pre-eminent in the group of organics which have grown from the manufacture of artificial colors.

Accelerators Are Important

There is no authoritative source of knowledge from which to draw statistics about the quantity of accelerators consumed in the United States, but unofficial estimates place the total in excess of 6,000,000 pounds annually. Disregarding certain accelerators manufactured by three or four of the larger rubber companies for their own exclusive use, the principal products of current industrial importance are diphenylguanidine, di-ortho-tolylguanidine, triphenylguanidine, resinous aldehyde-amine derivatives, unpolymerized aldehyde-amines such as methylene-dianilide or anhydroformaldehyde-para-toluidine and a few so-called ultra accelerators, typified by tetramethylenethiuramdisulphide or compounds relating to it.

Although organic chemicals have been used for many years in pneumatic tires and tubes, as well as solid truck tires and other rubber products containing a high percentage of new rubber, it is only within the past year or so that their value as accelerators has been recognized for the production of insulated wire, auto-top materials, garden hose and packings. The price trend for accelerators has been decidedly downward for the past five years due both to the development of more favorable raw material costs and the continually increased consumption that has made possible substantial economies in their preparation. The principal sources of supply exist in New Jersey, New York and Ohio, while the chief consuming centers are in the Middle Western States, New England and New Jersey with new markets rising on the West Coast where a branch of the rubber industry is growing to meet the needs of the motoring public of that region.

There is little prospect of serious competition from abroad because the European rubber industry is so small, in contrast with ours, that their consumption of organic accelerators does not permit British and continental chemical manufacturers to produce these substances in sufficient quantity to realize the low production costs prevailing in America. Moreover, foreign suppliers would find difficulty in keeping pace with the changing conditions here because the greatest advances in the science of industrial rubber products has been developed in the United States where the future preference seems inclined toward the utilization of still more efficient compounds than any of those in wide commercial use today.

Use of Xanthate Increases

Potassium xanthate has practically displaced every other type of flotation reagent and in less than two years the consumption of this previously little used chemical has mounted to about thirty million pounds, having a valuation of close to $865,000.

It is used as a collecting reagent in conjunction with a frothing oil, or a pulp conditioner in combination with both a collecting and a frothing oil to concentrate, by the flotation process, the sulphide ores of copper, zinc, lead, silver and gold. Not only is potassium xanthate the finest collecting reagent so far developed, but it also conditions the ore pulp in such a way that the ore, or its concentrate, can be handled in flotation cells, on filters and in thickeners far more efficiently than was possible with the chemicals previously employed for this purpose.

Such low metal production costs have been achieved with its use that the prospects of finding a low priced chemical to displace it, by reason of the latter's still greater effectiveness, are rather remote. The chief sources of supply are located in New Jersey, Ohio and California, while the Western United States, Canadian and Mexican mining districts constitute the principal consuming markets.

Ethyl Gas Situation

Pending a decision of the committee of eminent physicians and health authorities appointed by the Surgeon-General of the United States Army to investigate and consider the possibility of deleterious effects from the use of ethyl gas, the principal active ingredient of which is tetra ethyl lead, the manufacture and distribution of that motor fuel was suspended in May and there has been a consequent delay in the anticipated announcement by prominent automobile manufacturers of cars equipped with the more efficient high compression motors. Meanwhile, petroleum distillers are offering motor fuels which contain a high percentage of coal-tar benzol or other derivatives of the cracking process that are claimed to reduce the knocking in over-strained engines.

Increased Demand Features Market For Lead Compounds

Greater consumption by automotive field for batteries, rubber products and other lead-bearing materials marks greater production

By O. C. Harn
National Lead Co., New York City

AFTER graduating from Cornell University, Mr. Harn entered the newspaper field and later edited trade papers. He has always been active in advertising circles, helping to organize the Association of National Advertisers and serving as its second president.

He is an occasional contributor to advertising publications and the paint trade press, and is also the author of "Lead, the Precious Metal."

OF ALL the chemical derivatives of the metal lead, white-lead is considerably the most important, industrially, the red-lead and litharge are essential in many fields and a tremendous tonnage of lead is sold in these forms.

White-lead, a fine white powder, is basic carbonate of lead, $2PbCO_3Pb(HO)_2$, the theoretical standard composition being 69 per cent lead carbonate and 31 per cent lead hydroxide. The standard specifications of the Federal Specification Board and of the American Society for Testing Materials, however, allow a variation of 65 to 75 per cent carbonate and 35 to 25 per cent hydroxide, with not to exceed 2 per cent impurities, including moisture. Its fineness must be such that not more than one per cent will be retained on a No. 325 screen.

Something less than 200,000 tons of white-lead are produced annually, for domestic consumption, factories being located conveniently throughout the country. There are plants in Brooklyn, on Staten Island, Perth Amboy, N. J., Philadelphia, Pittsburgh, Scranton, Pa., Cincinnati, Cleveland, Chicago, St. Louis, San Francisco and Montreal.

Some white-lead is exported, but on account of the lower price of pig-lead abroad, export white-lead is manufactured in bond from foreign pig-lead.

The largest use of white-lead is as a paint pigment. Probably more than 85 per cent of the total production is thus used, either as an ingredient of ready prepared paints which contain more or less of it, according to the grade of the paint, or as the exclusive pigment base of old-fashioned "lead-and-oil" paint mixed for the job by the painter. The latter use is by far the greater, probably 75 to 80 per cent of the total tonnage being sold through the trade as white-lead-in-oil, i.e., a fairly stiff paste made up from 8 to 10 per cent pure linseed oil and 92 to 90 per cent white-lead. This is the Federal Specification Board and A. S. T. M. requirement for white-lead-in-oil. In addition, these specifications require a maximum of 0.7 per cent moisture and volatile matter and, as a standard of fineness, a maximum of 1.5 per cent remainder on a No. 325 screen. The more liberal allowance over the fineness specifications for dry white-lead is necessary on account of the presence of oil which may oxidize and produce skins, etc.

White-lead-in-oil is sold f.o.b. manufacturing points and certain recognized delivery points, the various manufacturers, however, differing in many instances in their lists of established points of free delivery. It is common also to equalize freight on shipments to non-delivery points with convenient selected delivery points. Free trucking zones are sometimes established in and around corroding or warehouse points but in this there is little uniformity of practice. Terms are usually 2 per cent cash in 10 days, net 60 days. Prices for standard brands in 1925 ranged from $13.16 per cwt. (carload lots) in January to $12.35 per cwt., which price prevailed steadily throughout the latter half of the year. Since the end of the war in 1918, prices have fluctuated considerably. The lowest price was $9.92, carload, in 1921, and the highest $13.56, in January, 1925.

The larger manufacturers usually announce a price in December for the coming spring selling season, guaranteeing distributors against loss on unsold stocks in case of a decline in the price before June 30, which is considered the close of the spring season. If conditions seem to warrant it the protection period may later be extended to cover the fall season. This arrangement is peculiarly adapted to the white-lead business for it requires three to four months to corrode white-lead and, if the manufacturers are to keep faith in providing adequately for public needs, estimated requirements must be met far in advance of actual use. If prices are uncertain distributors will not buy, and, without protection to the distributor the manufacturer would have to store his tonnage. With no stocks on his floor the dealer often will not be able to meet current early season demand, to the irritation of the consumer and loss to dealer and manufacturer. With a guaranty of protection behind them dealers take their stocks early and begin to dispose of them early, so that in case a decline in price comes it finds their stocks largely moved out and in consumption.

White-lead-in-oil is sold for the most part in 100-lb. steel drums and in steel pails of 50, 25 and 12½ pounds net contents. One and 5-lb. tins, packed in boxes, are also supplied. The small tins are purchased mainly for cementing pipe joints and miscellaneous household use. Large trade may obtain white-lead-in-oil in 250 and 500-lb. wood casks if desired. The usual trade discounts except on the Pacific Coast are 10 per cent on 500 lb.; 10 and 4 on ton lots; 10 and 7½ on 5-ton lots; 10 and 10 on carloads, the minimum car being 15 tons. These discounts are from a list price which, so far as published cards are concerned, is fairly uniform. Competition, however, leads to variations, which

come largely in the form of allowance of large quantity discount on a smaller quantity shipment, free delivery, at points which are not usually so favored, etc.

Dry white-lead is sold mostly in large packages, 500-pound barrels or larger, and contracts are usually made for a period's requirements. Prices during the year have ranged from $12 per cwt. in January to $10.25 per cwt. the latter half of the year. The range in the last seven years has been from $7.25 to $12, the lowest price being recorded in 1921, since which time prices gradually rose to $12 in January, 1925.

White-lead-in-oil is generally sold through jobbers and retailers, though in the paint trade there is no such hard and fast demarcation between these classes as there is in most trades.

Dry white-lead is sold direct to manufacturers, very little passing through the trade. There is therefore no series of discounts. The largest aggregate consumption is by manufacturers of prepared paint. Their requirements are fully met by the government and A. S. T. M. specifications already given. Potters use white-lead as an important ingredient in the glaze with which the crude clay forms are beautified. Any form of lead derivative—carbonate or oxide—is usable for the purpose, but most potters prefer white-lead for the finest wares. Freedom from metals, other than lead, is the potters' chief requirement of white-lead. Especially must iron be absent and copper too, both of which discolor the glaze. This specification is not difficult to obtain as white-lead is made from pig lead purified in the operation of desilverization. The rubber manufacturer who uses white-lead requires only that it be commercially pure and be free from metallic impurities. Even metallic lead must be absent for iron, lead or any metallic particle would puncture the sheet. Copper in any form is barred for it deteriorates rubber. Even when rubber is used to insulate copper wire the latter must be tinned so that the copper and rubber do not come in contact with each other.

The Lead Oxides

The lead oxides, litharge and red-lead travel hand in hand in industry and are often apparently interchangeable. Thus some battery makers use red-lead for negative plates whereas most use litharge. Also, in the making of pottery and enamel ware glazes, litharge is sometimes used, sometimes red-lead. Their chemical and physical characteristics are different, however, and for many purposes one is suitable while the other is not. The considerable difference in price, moreover, leads to the use of litharge wherever possible, which fact of course makes it clear that when red-lead is chosen in an industry where both are largely used it is because of some definite advantage.

Both oxides are sold either at a flat price per pound or, in case of large contracts covering a period, frequently at a specified differential above price of pig-lead. Prices for litharge during 1925 ranged from $13.25 in January to $11 per cwt. in June. The present price of $11.75 has prevailed since September. The range in the last five years has been from $7.50 per cwt. to $13.25 per cwt., the lowest price being recorded in 1921. Dry red-lead ranged from $13.75 per cwt. in January of this year to $11.50 per cwt. in June. During the fall and winter, the price of $12.25 per cwt. has prevailed. In the last five years prices have ranged from $8 per cwt. (in 1921) to $13.75. During the latter half of 1925 red-lead-in-oil has been steady at $16.75 list, from which trade discounts for quantities similar to white-lead-in-oil discounts are granted. The highest price of the year was $18.25 per cwt., list, in January. Prices for red-lead-in-oil during the last five years have ranged from $14 per cwt. to $18.25 per cwt., the lowest price being in 1922.

The combined production of these oxides has been totaling in the neighborhood of 100,000 tons per year. In 1923 this figure was considerably exceeded, while in 1924 production ran below 100,000. The figure for 1925 is not available but it will possibly be about 105,000 tons. The manufacture of lead oxides is conveniently dispersed throughout the country, factories being located in Brooklyn, Long Island City, Philadelphia, Franklin, Pa., Pittsburgh, Charleston, W. Va., Cleveland, Cincinnati, Chicago, St. Louis, Joplin, Mo., San Francisco and Montreal.

Litharge

Litharge, the most largely consumed lead oxide, is made by roasting pig-lead in a suitable furnace in the presence of air at a high temperature, in which operation the lead unites with oxygen, atom for atom, forming lead monoxide, a fine yellowish powder whose chemical formula is PbO. It is usually made in a reverberatory furnace, but sometimes in a cupel furnace, which produces a flaky product. The latter is preferred by glass makers because the coarser, flaky litharge is less dusty and easier to handle in their mixes.

The only general specification of record for litharge is that of the U. S. Navy. It requires that there shall be a minimum of lead monoxide (PbO) and that the maximum total impurities be 1 per cent, including matter insoluble in water and in a mixture of nitric acid and hydrogen peroxide. The maximum true red-lead (Pb_3O_4) allowed is 0.3 per cent. As to fineness, the maximum left on a No. 325 screen, 3 per cent. Litharge is usually packed in 500-lb. barrels, wood or steel, the latter generally being of the returnable type. All specification figures, it should be borne in mind, are based on the practicability of tests—the tolerance to be permitted, the degree to which test figures can be made to agree by different operators, etc. Therefore a certain breadth must be allowed to meet such contingencies and no specification can be considered best except as it is generally applicable.

Glass-makers use probably 600 tons of litharge a year. Their preference is for the higher oxide of lead, red-lead, of which they use much more. Both must be free of the discoloring iron and copper impurities and metallic lead must not be present in larger proportion than 0.1 per cent. Coarse litharge is usually preferred but not essential. Potters and enamel-ware makers use a very large tonnage of litharge, probably 4,500 to 5,000 tons per year. Their requirements are about the same as glass-makers as to freedom from discoloring metallic impurities, for the glaze in which they use it is essentially a glass; but they prefer it fine (Navy specification). The metallic lead content should not be more than 0.2 per cent.

Color makers use a very large portion of all the litharge manufactured, the annual tonnage probably averaging 5,000 tons. As the color maker uses it for precipitation when dissolved in acetic acid to make lead chromate (a yellow pigment) his chief requirement is rapidity and completeness of solubility. It should be fine but not so fine as to "ball up" in the tanks. Iron

and copper content should be low, as for glass-makers, but not for the same reason. In the color makers' business these metallic impurities would interfere with the cleanness of the solution and would contaminate the precipitated color.

The growth of the storage battery business is traceable in the growth of litharge and red-lead sales in the last fifteen years. In 1909 the total litharge production in this country was given as something over 13,000 tons. In 1924, three times as much litharge was used for battery making alone as the total production for all purposes in 1909. The storage battery as used for automobiles, radio and central stations is a lead product throughout with the exception of the electrolite, separators, and containers. On grids made of cast lead litharge (usually, though sometimes red-lead) is pasted to make the negative plates; while red-lead, or a mixture of litharge and red-lead, is pasted thereon to make the positive plates. Battery-makers find no objection to slight quantities of metallic lead in their litharge as, on charging the battery, the oxide on the negative plate returns to lead; but the litharge must be free from iron and copper, as these metals produce injurious electrolytic action. As to fineness, the litharge should be neither extremely fine nor extremely coarse. Within these limitations there is considerable difference of opinion and practice among different manufacturers.

The rubber manufacturer uses litharge as a cure accelerator and toughener in the curing mix, the essential ingredient of which is sulphur. Probably 10,000 tons of litharge goes into this industry, mostly in mechanical goods, clothing and that type of rubber. It must be free from copper in any form and metallic impurities, to prevent perforation and to avoid electrical conductivity where the rubber is used for insulation. The rubber maker prefers a fairly finely pulverized litharge.

Varnish maker's litharge, like that used by color makers, must be fine enough to quickly and completely dissolve, yet not be so fine as to ball up in the boiling kettles. The varnish maker uses it as a drier in his varnish. Metallic lead is objectionable as it would melt and collect at the bottom of the kettle. From 1,000 to 1,500 tons of litharge are used for this purpose. Linoleum manufacturers also use litharge and as their employment of it is similar to that of the varnish manufacturers, namely, as a drier of linseed oil, their requirements are the same. Possibly 500 to 600 tons go into this industry every year. Oil refiners and insecticide manufacturers also have requirements similar to those of the varnish maker, for both use their litharge in solutions.

Litharge is used in the refining of petroleum oils. The tar-producing substances in the oils are refined out by means of sulphuric acid. The process leaves sulphur compounds and some acid in the oil. To eliminate these, sodium plumbite, is introduced into the oil and stirred up with it. The sulphur unites with the lead of the sodium plumbite solution, forming lead sulphide, which is drawn off as a sludge. The oil refiner makes his sodium plumbite by dissolving litharge in a solution of caustic soda. His requirements are therefore a litharge which will dissolve readily and completely, which means that it must be neither too fine nor too coarse and should be commercially pure so that he gets the lead content he pays for. Oil refining makes a demand of approximately 4,000 tons of litharge per year.

Insecticide makers use 3,000 tons of litharge per year in precipitating lead arsenate. First lead acetate is produced by dissolving it in dilute acetic acid under the influence of heat. A solution of the lead acetate, or sugar of lead, is then mixed with a solution of sodium arsenate, which precipitates lead arsenate. Sometimes lead nitrate solution is used instead of lead acetate, but in this case also the insecticide maker starts with litharge.

Red-Lead

Red-lead is a higher oxide of lead than litharge, containing three atoms of lead and four of oxygen. After litharge has been made by oxidizing pig lead, the oxide is taken out of the furnace and, if red-lead is desired, the litharge is ground and put back into the furnace and subjected to a second burning at a temperature considerably less than that used to make the litharge in the first place. The second burning forces the litharge to take on more oxygen and as it does so, it turns to an orange red color, familiar to every one as the protective covering of the steel skeleton of skyscrapers, bridges, etc. This is red-lead. The chief consumption of this lead oxide is in painting, in storage batteries, in glass making, in glazes for pottery and enameled iron ware and in varnish making. Between 35,000 and 40,000 tons of this oxide are consumed for these purposes annually.

Red-lead is manufactured in various grades from the standpoint of completeness of oxidation. All may be equally "pure," for the residual litharge is not an impurity, though it may be objectionable for certain purposes. Painter's red-lead, according to the standard specifications, may contain as much as 15 per cent litharge, but the tendency of the times is to use the higher grades for this work. The advantages being a finer pigment which does not set so quickly when mixed with oil and which brushes out farther and in a more uniform film. To make a red-lead and linseed oil paste which will stay soft the prescribed three months, at least 97 per cent true red-lead is necessary. The use of this grade is small compared with the total tonnage but it is growing as its advantages become known. Probably 1,000 tons of red-lead of all grades go into the painting of structural steel every year and more than twice that quantity goes into storage batteries, most of which is used to paste the positive plates.

As noted in regard to litharge more red-lead is sold for batteries today than was used for all purposes 20 or 10 years ago, though the proportionate growth has not been so great. It is safe to say that two-thirds of the red-lead produced at present is taken by storage-battery manufacturers. The average grade used is from 70 to 80 per cent true red-lead but many prefer a much lower oxidized product. The variation in practice is due to the fact that mixtures of red-lead and litharge are much used and the preference for higher or lower grades of red-lead depends on the particular formulas favored in any particular case. The red-lead must be medium fine. Purity requirements are the same as for battery litharge.

The third largest user of red-lead is the glass manufacturer. He prefers a low oxidation, from 50 to 60 per cent true red-lead, with a purity the same as described for glass makers' litharge. The preference is for flake and coarsely pulverized litharge, to eliminate dusting. Glass makers use approximately a thousand tons of this oxide annually. Potters and

manufacturers of enameled iron ware account for 500 tons of red-lead consumption yearly, though as stated before, the lead oxide used by them in much the greater quantity is litharge. Their demands on the point of purity are the same as in the case of litharge and they want it finely pulverized. It is used in the glaze. Varnish manufacturers use between 500 to 600 tons of red-lead as a drier and the requirements are the same as for the litharge they use. The preference is for 80 to 85 per cent true red-lead, finely ground.

Orange Mineral

A special form of red-lead is known as orange mineral. Its consumption is small compared with other forms of red-lead, but the product is of great importance in certain fields. In chemical composition it is identical with red-lead, but it is made differently and is distinguished by and valued for its beautiful bright uniform orange-red color. Orange mineral, or orange lead, as it is called abroad, is usually made from white-lead by roasting in a furnace. Its chief use is as a base for the color known as eosin lake, or imitation vermilion. This color is made by precipitating eosin on the orange mineral as a base. It is used by color makers and printing ink manufacturers. Orange mineral is usually of about 95 per cent true red-lead grade and must meet requirements of color and tone.

Orange mineral being made from white-lead and requiring extreme care and special skill in manufacture, is the highest priced dry red-lead on the market, best brands usually bringing 2 to 2.5 cents more per pound than ordinary red-lead. Not all red-lead makers make this specialty and for many years the imported article had the field to itself. Orange mineral of the highest grade has been made in this country for a number of years, however, and has practically superseded the foreign product.

Basic Lead Sulphate

White basic lead sulphate is a pigment resembling white-lead in appearance but, as its name indicates, having a different chemical composition and certain different physical characteristics. It is sometimes known as sublimed white-lead, that being a proprietary name. It is a fumed product and analyzes about as follows: Lead sulphate, 80 per cent; lead oxide 15 per cent; zinc oxide, 5 per cent, the presence of the latter being due to zinc in the ore. The specification for this product adopted by the U. S. Interdepartmental Committee on Paint Specification Standardization and published in the Bureau of Standards, Circular No. 85, limits the lead oxide content to between 11 and 18 per cent and the zinc oxide content to a maximum of 9 per cent. Impurities, including moisture must not exceed 1 per cent, the remainder must be lead sulphate.

White basic lead sulphate is made from ore which is composed of galena (lead sulphide) and blende (zinc sulphide) the former being greatly in excess. The concentrates of this ore are treated in a proper furnace, volatilization takes place and the fume which results from oxidation of the volatilized portion of the concentrates is caught in bags. This product is used chiefly in the prepared-paint industry. A very little goes to rubber manufacturers. The annual output ranges from 12,000 to 14,000 tons and all of it is produced at two points, Joplin, Mo. and Collinsville, Ill. The price of white basic lead sulphate has risen in recent years and now is usually found ranging from a half to three-quarters of a cent under dry basic carbonate white-lead prices. It is shipped in 500-lb. barrels.

Blue Basic Lead Sulphate

Blue basic lead sulphate differs in some particulars from the white, the chief noticeable difference being in the color which is a bluish slate. This product is also a fume but it comes from the smelting of galena ore to produce pig lead and the operation leaves the fume with an excess of lead oxide, together with some lead sulphite, lead sulphide, zinc oxide and carbon. It is the lead sulphide and carbon, both of which are black, which turn the pigment to a slate color. It is used chiefly by rubber makers and as a paint for structural steel. The quantity used is small, not much over 1,000 tons, and no general specification exists. The price and package are the same as for the white.

Sugar of Lead

Sugar of lead is lead acetate, a chemical compound resulting from the reaction of lead oxide and acetic acid. The chemical formula is $Pb(C_2H_3O_2)_2 \cdot 3H_2O$. It is made by dissolving litharge with the aid of heat in dilute acetic acid. As the hot solution cools the lead acetate crystallizes out, the first to come off is known as white sugar of lead, the last as brown sugar of lead. The latter is not really brown but slightly off a pure white. The discoloration is due to slight impurities and renders it undesirable for some purposes. It is perfectly satisfactory for making lead arsenate for insecticides and certain other purposes where clean solutions are not essential.

The U. S. pharmacopeia requires white sugar of lead to be 99.5 per cent $Pb(C_2H_3O_2)_2 3H_2O$ and virtually free from other metals, sodium, potassium, calcium and magnesium; when dissolved in water recently boiled the solution must be only slightly turbid.

The white sugar is sold in various forms known in the trade as crystals, broken, granular, powdered and solution. The brown is usually in the form known as broken. The white crystals are irregular shaped and slender, ranging from a half inch to six inches in length. Broken sugar either white or brown, is broken from slabs approximately three inches thick into irregular pieces averaging two inches square. The granular acetate resembles granulated sugar and it is this form, together with the sweetish taste, that is responsible for its popular name of sugar of lead. Powdered lead acetate is in the form implied. Lead acetate solution is a liquid of 36 degrees Baumé test and has all the chemical characteristics of the solid. It is boiled only to a point where it will remain liquid. The lead content of the crystals is about 55 per cent, in the broken and in the granular about 58 per cent.

Color makers and some other users require the white sugar free from organic impurities. It is used by varnish makers as a drier, by color makers and paper manufacturers for producing chrome yellow, by dyers and printing ink manufacturers, in bleacheries, by horn button manufacturers as a whitening agent, for medicinal purposes, in the mining industry to remove soluble sulphur from cyanide solutions, etc.

The principal centers of distribution are in the New England States and in New York and New Jersey. The price for ten years has averaged around 14 cents. Sugar of lead is generally packed in barrels of 500 to 800 lb., though in kegs if required.

Sulphuric Acid Industry Prepared to Meet Heavy Demand

Expansion of production during last decade and low brimstone costs combine to depress prices to pre-war level

By William M. Rand
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THE strengths, concentrations, as well as the physical and chemical requirements of this acid vary greatly with the uses to which it is put. For the purpose of standardization, three commercial strengths are on the market, namely, 50 deg. Bé., 58 deg. Bé. and 66 deg. Bé. The first and second are called chamber acid and the third, oil of vitriol. The probable reasons why these strengths are used in the marketing of this acid are (1) freezing points, and (2) corrosive action on iron and steel. The freezing points of sulphuric acid do not vary with regularity according to the strength of concentration. Following is a table of the freezing points of the material. It may be seen that 50 deg. Bé., 58 deg. Bé. and 66 deg. Bé. oil of vitriol have very low freezing points, and therefore may be shipped with safety.

Deg. Baumé	Freezing Point, Deg. F.	Deg. Baumé	Freezing Point, Deg. F.
0	32.0	50	–27
5	28.1	55	Below –40
10	22.8	58	Below –40
15	14.7	59	–7
20	1.6	60	12.6
25	–23	65	33.1
30	–74	65¼	24.6
35	–81	65¾	–1.0
40	–41	66	–29.0
45	–20		

Sulphuric acid above 50 deg. Bé. does not act readily on steel or iron, whereas below that concentration the action is so rapid that it is impossible to ship the material in tank cars.

For the great tonnage of sulphuric acid there are no particular specifications, with the exception of strength. For certain industries, however, there are requirements calling for acid of better quality. Water-white acid is necessary in many industries. This means that there can be no organic matter in the acid, as the slightest amount of organic matter changes sulphuric acid from a clear, crystal white to a dark brown color. In the use of sulphuric acid for electric batteries, a particular grade is necessary, which must practically be free from iron, as iron in the acid is injurious. The common complaints of sulphuric acid users are (1) that it contains niter, (2) that it contains iron or other metals, and (3) that it contains arsenic. Arsenic in the acid is practically eliminated when the material is made from brimstone, but it may remain in acid made from pyrites or other ores. Besides the grades mentioned, there are a number of other strengths in use, and sulphuric acid may be shipped in any strength that is required, from chamber acid to oleum.

It is estimated that about 7,000,000 tons is produced annually in the United States. Fifty-two per cent of the total consumption of the acid is used in the manufacture of fertilizer. Phosphate rock treated with it forms acid phosphate, so necessary to the farmer for maintaining the fertility of his land. Petroleum refining, including oils, gasoline, naphtha and paraffin, requires an additional 12 per cent. Tens of thousands of tons go into the steel and iron mills for pickling or cleaning the metal. This industry takes 8 per cent. The textile industry takes but 3 per cent of the consumption, but its uses for bleaching, for mercerizing cotton and for burning out the vegetable fibers in wool are important. Miscellaneous uses amounting to 10 per cent of the consumption are so numerous that to attempt to mention all of them here would be an impossible task. Some of these uses are in the refining of sugar, the manufacture of ceramics, the purification of coal gas, the tanning of leather, the manufacture of fungicides, the reclaiming of rubber, the manufacture of soap and of yeast, in photography and—two very important uses—in metallurgy and in explosives. In metallurgy besides its employment in cleaning steel, iron, copper and silver, it is used in the flotation of zinc, copper and lead ores. The much mooted question, "Who won the war?" may be settled by compromising on that modest, retiring applicant for the honor—sulphuric acid! Without it there could have been no high explosives. The nations producing the greatest amount of explosives held the balance of power. Sulphuric acid is a necessity in the manufacture of dynamite, picric acid, T.N.T. and other high explosives. During the Great War the government had plant capacity for a million tons of sulphuric acid, which, when added to the capacity of industrial plants brought the total supply to the allies of the United States to 10,000,000 tons per annum. Many of our common comforts and luxuries, which we have come to look upon as necessities, would be impossible without sulphuric acid. Industrial progress would be turned back over a century and a half. It is summed up by a distinguished German, who said in effect that a nation's civilization is measured by its consumption of sulphuric acid.

Eighty-five per cent of the consumption has been accounted for. The important user, the chemical industries, requires the remaining 15 per cent. Sulphuric acid makes possible directly hundreds of manufactured articles, and indirectly it assists in the manufacture of thousands more. It is the key chemical. Its consumption by industry exceeds that of any other chemical. Let it suffice to mention a few of the more important chemicals in the manufacture of which sulphuric acid plays an important part. Through a process of treating salt and sulphuric acid, muriatic

acid is formed. This acid is used in the gelatine and glue industries, the sugar industry and the iron and steel industry. In fact it may replace sulphuric acid in scores of uses. Salt cake is a byproduct obtained in the manufacture of muriatic acid. This material enters the manufacture of glass and of strong wrapping papers. Salt cake crystallized gives Glaubers salt, which is used in the dyeing processes of the textile industry. Bauxite treated with sulphuric acid makes sulphate of alumina, invaluable in the filtration of water and in the manufacture of paper. Gas from coal distillation treated with sulphuric acid produces sulphate of ammonia, an important fertilizer. Nitrate of soda treated with sulphuric acid gives nitric acid, important to the dyer and engraver. Nitric acid itself, mixed with sulphuric acid forms mixed acid, used in nitrating cellulose. This is the base of artificial leather, pyroxylin, celluloid and many explosives. Sulphuric acid with various coal-tar products produces many dyes and intermediates. With the mixture of sulphuric acid, salt and acetate of lime we have acetic acid, the important uses of which are in the manufacture of solvents, paint, varnish, perfumes and drugs and in dyeing.

The principal centers of distribution in the United States are Boston, New York and Northern New Jersey, Baltimore, Philadelphia, Birmingham, Ala., St. Louis, Cleveland, Pittsburgh, San Francisco and Denver.

The acid is shipped for the most part in four kinds of packages, namely, carboys, drums, tank trucks and tank cars. Carboys are glass bottles containing 13 gal., the bottles being enclosed in wooden boxes. There are various methods of cushioning the bottles in the wooden boxes, among the best of which is the Smith Carboy, invented and developed by John Smith at the works of the Merrimac Chemical Company. In this carboy, cork cushions are placed against the strongest points of the carboy bottle to withstand shocks. The carboys must pass rigid inspection before they are allowed to be used in Interstate Commerce. Sulphuric acid may be shipped in drums if the strength is over 65 deg. Bé., but not if the acid is under this strength, the regulations of the Interstate Commerce Commission not permitting shipment on railroads because of the danger from corrosion of the metal, thus causing leakages. Tank cars are used for any acid above 50 deg. Bé. These cars are cylindrical, single-unit steel cars filled through domes at the tops of the cars, and emptied by air pressure. The acid is stored for the most part in tanks, and steel tanks may be used for this purpose, although if storage is needed for weak strengths, it is necessary to line the tanks with lead.

The usual quantities sold for commercial uses are, first, in carboys. These contain 13 gal. and weigh about 195 lb. net and 275 lb. gross. The next quantity is in drums. These contain 55 gal. and weigh 800 lb. net and 910 lb. gross. For deliveries near the producing plant, tank trucks may be used. These trucks have tanks which have a capacity of about 7 tons. The usual tank car capacity is 50 tons. In shipping regulations, the acid is classed as a corrosive liquid. For shipment on vessels, carboys are stored on deck, and freight may be charged at the rate of 14½ cu.ft. per carboy.

Prices on this acid are quoted by the pound and by the ton, rather than by the gallon. Most of the prices are quoted at the following strengths, 50 deg., 58 deg., 66 deg. and 20 per cent oleum, which is 104.5 per cent equivalent H_2SO_4. The prices are quoted f.o.b. the works of the seller. Following is a table of the average prices of the material over a period of years. The high prices during the War came about on account of the tremendous demand, and the lack of facilities to take care of it. Subsequently, the facilities that had been built to care for the demand for sulphuric acid during the War, caused a sharp decline in price to 1914 levels. Prices per net ton have been as follows:

1913	$14.00	1920	25.00
1914	14.00	1921	20.00
1915	22.00	1922	15.00
1916	28.00	1923	14.00
1917	30.00	1924	14.00
1918	28.00	1925	15.00
1919	25.00		

The producing industry is not large when sulphuric acid alone is considered, but as it is the basis of the chemical industry, its importance is far greater than its capitalization would indicate. The principal producing plants in the United States are listed as follows:

Alabama	9	Mississippi	5
Arizona	2	Missouri	5
Arkansas	2	Montana	1
California	8	New Jersey	14
Colorado	3	New York	7
Connecticut	3	North Carolina	6
Delaware	3	Ohio	10
Florida	4	Oklahoma	2
Georgia	32	Pennsylvania	21
Illinois	15	Rhode Island	2
Indiana	3	South Carolina	8
Kansas	2	Tennessee	8
Kentucky	1	Texas	3
Louisiana	1	Utah	1
Maryland	13	Virginia	10
Massachusetts	4	West Virginia	2
Michigan	5	Canada	1

The principal raw material for the manufacture of sulphuric acid is brimstone. The supply of this at the present time is sufficient for some years to come. Previous to the use of brimstone in the manufacture of sulphuric acid, pyrites was used. There is a supply of pyrites sufficient to care for the industry for a long period of time. Large quantities of sulphuric acid are made from the recovery of gases in the smelting of ores. SO_2 gas cannot be discharged into the atmosphere without severe damage in the neighborhood of the plant, consequently this gas is recovered for the manufacture of sulphuric acid.

The commercial processes of manufacturing sulphuric acid are two. First, the roasting of sulphur-bearing ores in furnaces, treatment of the gases in large lead chambers with water vapor and nitrous gases. This produces "chamber acid." This process is used at smelting plants and in metal refineries, where waste sulphur dioxide gases must be recovered. The largest production of sulphuric acid comes from the chamber process. The other process is the contact method. By this process, any concentration of the acid may be made.

On account of the low prices of sulphuric acid, which is sold at the strength of 50 deg. Bé. at about $6.00, there is no foreign competition in the United States. In the event of byproduct acid being produced in Canada, severe competition will probably prevail along the northern borders of the United States, but up to the present this has not been an important factor. There is no tariff on imports of sulphuric acid.

Progress in Technology in 1925

INDUSTRIAL development in the United States is showing, sometimes in spectacular manner, the influence of better technology. Research, development and production follow each other in swift succession without regard to time as measured by the calendar. Hence it is not always feasible to appraise accurately the achievements of a given year; but as far as that is possible the editors of *Chem. & Met.* have endeavored in the following notes to review the important technical developments in major industries during 1925.

Coal Carbonization And Synthetic Chemicals

DURING each of the last few years the manufacture of gas, coke and other coal products, has been characterized by the introduction of improved processes and equipment. Forward steps such as the "backrun" process of water gas manufacture and the Becker design of coke oven have been some of the milestones of annual progress.

But 1925 saw progress of a different type—progress that promises to revolutionize the carbonization industry in all its phases. For the first time some of the many projects for the synthetic manufacture of such products as ammonia, methanol, motor fuels, and alcohols have proved commercially successful. Stimulated by the importation of synthetic methanol into this country from Europe, that commenced early in the year, many chemical companies have become interested in these processes. This interest has, in the case of ammonia, already been translated into action and a large increase in the production of the synthetic product will occur early in 1926. The manufacture of other synthetic products is under consideration in several quarters and there is little doubt that plants will be built and commercial production commenced in these fields at an early date.

The importance of this development for the coal carbonization industry lies in the fact that coal forms the raw material upon which these new processes depend. Coal gas, coke-oven gas, or water gas, as the case may be, form the starting point for these synthetic products, all of which are combinations of oxygen, hydrogen, nitrogen and carbon. Hence the coal carbonizing industries are assuming a new position. Up to the present time, the domestic market for gas and the market for coke in the iron smelting field have controlled the growth and operation of coal carbonization. Whatever the other demands on the industry might be, they have had to wait on these two major markets.

If, however, as now looks probable, coal carbonization becomes basic to the synthetic production of large quantities of such products as motor fuel and methanol, then a new controlling factor will enter the market. In order to supply the demand for any large quantity of such products through synthetic manufacture, a very great expansion of the carbonizing capacity of the country will be necessary. For instance, to manufacture 25 tons of synthetic ammonia per day from water gas will require a gas producing capacity sufficient to supply a city of 200,000 population. The manufacturers of these synthetic products will therefore use a large quantity of coal, the winning of which they will be obliged to control. They will also have available byproducts in the form of fuel gas and coke, in addition to the usual byproducts, such as tar and light oil, in quantities sufficient to make them the controlling factors in the gas and coke markets.

This means that, starting at the mine and carrying through carbonization to the marketing of the gas, coke and other products, the manufacturer of synthetic chemicals based on gas or coke will shortly dominate the field. Just what changes in technical, sales and financial control this coming condition presages, it is hard to foresee at the present. That the changes will be revolutionary is certain. And the proper working out of the new alignment that will come must command to the full the abilities and co-operation of engineers in both the carbonization and chemical fields.

Corrosion Research Taking Practical Turn

NEARLY a quarter century ago Whitney proposed a fundamental reaction for the corrosion of iron, and upon this foundation has been erected the modern electrolytic theory, which today enjoys almost universal acceptance. True, the proponents of the colloidal and carbon dioxide theories have had a measure of success; but all in all, their work has but strengthened the present position of the electrolytic theory.

To investigators such as Whitney, Walker, Bancroft, Speller, Friend, Wilson, Evans, Bengough, Heyn and Whitman is due everlasting credit for giving applied science and engineering a sound workable theoretical basis, thus making possible rapid advance in further corrosion research, and especially in its practical industrial aspects. That such progress already has been made, both in the ferrous and non-ferrous divisions, is attested by some of the excellent papers published during 1925. Carl Benedicks, director of the Metallographic Institute of Stockholm, has continued his work on boiler tubes and condensers, and it has been established that pitting is due to localized films of air that insulate the wall of the tube from the liquid, thus allowing a temperature rise on the liquid side of the wall, and causing selective corrosion. Once begun, the formation of pits is of course greatly accelerated, as it becomes easier for the gas bubbles to adhere. As far back as 1908, Benedicks showed that so tenacious is an air film on hot metallic surfaces "that no practicable increase in the water speed prevented it." As to a practical means of preventing pitting from the foregoing cause, none seems to have been found. Closely related to the work of Benedicks, is that of Bengough and May on the corrosion and protection of condenser tubes. Of the various types of corrosion, dezincifica-

tion, pitting, and impingement attack have been thoroughly studied, and definite means of retarding or preventing such action suggested.

From the economic standpoint, one of the heaviest of corrosion losses is that of underground pipe, as the investment of public utility companies, municipalities and private industry in these structures probably exceeds one billion dollars. The committee on corrosion of metals of the American Foundrymen's Association, in co-operation with such agencies as the National Research Council, A. S. T. M., and Bureau of Standards, is attacking this problem with vigor. As the Committee's reports are based on the results of sub-surface exposure tests continuing over a variable period of years, final conclusions must be deferred; but progress thus far has been encouraging.

Another fertile field for corrosion study is the petroleum industry, both in the producing and refining functions. Here nearly every possible type of problem—natural water, salt water, acid, aërial, and sub-soil corrosion—awaits the preventive that would save millions of dollars annually. An excellent survey of oil and gas field conditions has been made by R. Van A. Mills of the Bureau of Mines, and his findings are exceedingly encouraging: That the exercise of good engineering judgment in the selection and protection of equipment will greatly lessen present losses.

Unquestionably systematic studies of other industrial groups would result in a similar conclusion; and at present, with an adequate groundwork of theory, the numerous practical corrosion problems should receive the greatest emphasis. Progress during 1925 has been notable and in the right direction.

Concentrated Fertilizer Materials as Products of Chemical Industry

STILL further progress toward the manufacture and sale of concentrated fertilizers was recorded in 1925. It is impossible to give figures estimating accurately the extent to which higher concentration plant foods have been marketed recently but there is no doubt that the campaigns of the Department of Agriculture and of the American fertilizer industry are bearing fruit.

The chemical industry is now ready to take active part in this progressive movement, particularly by furnishing commercial supplies of high concentration materials. The Liljenroth process promises to supply ammonium phosphate; the Lidholm process has already been demonstrated as a technical success in the pilot plant for urea manufacture; double and triple superphosphates are now generally available and recognized as important fertilizer constituents.

The most striking development during the past year has been in the large expansion of direct synthetic ammonia plants. There are now eight such plants either operating or about ready to operate, and the prospects are that 1926 will see a production of direct synthetic ammonia at least five times as great as during 1924. If the success anticipated for these plants is realized, more are sure to follow; and synthetic ammonia will then become a material factor in the fertilizer industry.

The return of the agricultural community to a more prosperous condition forecasts large and early increase in fertilizer demands. It is fortunate that this is to be met with increasing concentration of plant food for the greatest economies can be realized in no other way.

The Anti-Knock Era in Petroleum Technology

AS THIS is written a report is momentarily expected from the committee appointed last May by the Surgeon General to study the possible hazard to the public health in the commercial use of tetraethyl lead as an anti-knock compound in gasoline. Since the future of this product is presumably dependent upon the outcome of the committee's investigation, it is, therefore, scarcely a fitting subject for editorial review and appraisal. On the other hand the influence of this development on the technology of the petroleum and automotive industries is part of the record of the past year's progress and as such is worthy of comment.

That there was a definite demand by the motoring public for an improved motor fuel was clearly shown by the national acceptance of the lead-treated gasoline. Even with the present type of motors, the avoidance of detonation and the greater power and more rapid acceleration thus obtained were luxuries for which the motorist was willing to pay a substantial premium. As this became apparent to the oil industry, a tremendous stimulus was given to research and development directed toward improved motor fuels. This study demonstrated, as such studies often do, a number of fundamentals that had long been known but never appreciated because never viewed with the proper perspective. Among other things, it was shown that the once despised "unsaturated" constituents were in reality highly desirable for their anti-knock properties. If a sufficient proportion of these olefines, naphthenes and aromatics which occur naturally in some gasolines and are produced synthetically in others as a result of cracking, are left in the distillate, rather than refined out of it, the fuel so obtained will give performance comparable with that of benzol blends or of gasoline that has been treated with the lead compound.

As the commercial significance of this was appreciated, several of the larger oil companies began to market anti-knock motor fuels of this character. Within the past few months the popularity of these products has greatly increased. Also the proponents of the different cracking processes have not been slow to seize upon the opportunity for emphasizing the merit of cracked gasoline because of its anti-knock properties. Soon the old-time prejudice against the cracked product in favor of straight-run gasoline may be exactly reversed and thus a still greater impetus be given to more general adoption of the cracking process.

The first anti-knock motor fuel was conceived as part of a program for greatly increasing the fuel efficiency of the internal combustion engine. In effect it marked the first evidence that the petroleum and automotive industries were willing to join forces in attacking their most important problems. The activities of the past year have brought the two industries even closer together with the realization that neither the oil technologist nor the automotive engineer can afford to proceed independently in designing the future automobile motor and developing the fuel on which it must depend.

For much of this progress a fair measure of credit must go to the tetraethyl lead development. Quite apart from its own contribution to motor efficiency, it has had a stimulating influence in pointing the way for greater service and, therefore, greater accomplishment in petroleum technology.

Unlimited Supplies of Synthetic Solvents

THE past year has seen outstanding development in the manufacture of solvents by synthetic methods from inorganic raw materials. Methanol, acetic acid, isopropanol, ethylene glycol, monacetin, paraldehyde, and a half dozen others of related sort are now being manufactured for the first time in large tonnage by new methods from such inorganic sources. This assures to industry indefinite increases in supplies of these solvents as the demand may grow.

In the past many of our solvents and organic chemicals have been byproducts. The output of such materials has of course been limited to some more or less fixed ratio to the major product. For example, glycerine, of which we produce some and import more, is available only in proportion to the fats hydrolyzed for soap and other uses. Even alcohol as now produced is dependent upon the supply of molasses which in turn is fixed by sugar refining.

No such situation will be met in the case of the newer synthetic solvents. So long as natural gas, petroleum, coke, and similar raw materials are not limited in supply, the output of these products need not be curtailed. Only the market price which they can command will limit the supply. Hence large users of these chemicals can contemplate further expansion at the present or even lower prices without hesitation. The supplies will not be lacking; nor will the prices be inflated with every new or proposed use, as often happens with chemicals of limited maximum supply.

Nitrogen Fixation and Ammonia Markets

ANY new chemical is likely to displace or disturb the market for an old commodity. The new products of nitrogen fixation afford no exception to this general rule. The ammonia liquor market is being radically changed as a result of the commercial expansion of nitrogen fixing plants and there is every reason to believe that even more radical changes are just ahead.

In the past all byproduct-coke works and coal-gas plants recovering ammonia preferred to sell ammonia liquor to the extent that a market could be found for this material. The market price for ammonia in that form was distinctly higher, considering the cost of production, than for ammonia marketed as ammonium sulphate. As a consequence there always was an abundance of liquor and the larger quantities which could have been produced were converted to ammonium sulphate, largely for lack of other market.

One of the big uses for ammonia liquor was the manufacture of anhydrous ammonia for refrigeration. Synthetic ammonia is produced in a form that lends itself directly to production of anhydrous ammonia at very little, if any, extra cost. Hence practically all of the synthetic product takes this market form and the demand for liquor is exceedingly curtailed. Another important use was in the making of powder liquor for explosives manufacture. One of the largest manufacturers of explosives now proposes to make most of his ammonia synthetically and thus the powder liquor market is also curtailed.

The result is that gas works and coke ovens must make less liquor and convert larger quantities of their ammonia yield into sulphate. This in turn affects the fertilizer nitrogen supply, our exports of ammonium sulphate, and even the price of imported Chilean nitrate. Truly, no industry can live to itself alone.

Better Technology Means Better Lacquers

TECHNOLOGY may appear to have been overshadowed by the recent commercial development of pyroxylin lacquers, but, as a matter of fact, it has been responsible for significant progress in both the manufacture and application of the new product. Better knowledge of lacquers, their limitations as well as advantages, has naturally come through their broader use and, conversely, this knowledge has stimulated their application.

In the manufacture, technical developments have improved the product by overcoming obstacles that formerly handicapped its use. One of these has been the lack of luster in the finished surface. The first nitrocellulose lacquers introduced to the automobile trade, gave a satiny, rather dull surface distinctly different from that of color varnish or enamel. To meet this objection, various finishing coats were used but without much satisfaction. Lately microscopic studies of lacquers in various stages of their use has demonstrated conclusively that the appearance of the surface is largely a property of pigment size. This discovery was followed by a modification in the manufacturing process to give a much smaller particle size to the already finely ground pigment. The result is a lacquer finish closely resembling that obtained by the older method yet with the greater durabilitiy and ease of application that characterizes the new product.

As the earlier finishes were lacking in luster, so, too, was there a definite limitation of color. The reds, for example, were the least satisfactory. In fact there are those in the industry who believe that had the first cars been finished in red instead of blue, the use of lacquer would have received an almost fatal setback. It is only in the past year that the deep maroon shades have been produced. To accomplish this special pigments had to be developed with properties not to be found in existing materials.

With the almost universal acceptance of lacquer in the automobile industry and the great progress in the finishing of furniture and various metal products, further stimulus has been given for the development of a product for household application. Lacquers that may be applied by brush instead of air spray have been introduced during the past year by some manufacturers. Others, and included in this group are the pioneers in the lacquer development, have continued their research in perfecting a product that will give satisfaction to even the most inexperienced. There is evidence that a few months will see the successful outcome of this research.

Among those who are looking farthest ahead in the lacquer industry, there is a growing feeling that the use of the nitrocellulose film may be only the first step in a much greater development. Research has been directed into the study of many other film-forming materials—such as certain organic condensation products that might have economic or technical advantages over pyroxylin. So far this inquiry is without imme-

diate results but it is a healthy sign of progress and a confirmation of the view that technology is keeping pace with, if not leading the way for, further commercial success in this new field.

The Methanol Menace and the Future of Wood Distillation

TWO VIEWS are current in the chemical industry to account for the decrease in the imports of synthetic methanol and the reported closing of the Badische plant. One is that the early reports of low costs and successful mechanical production were too optimistic and that the Germans are now facing the technical and economic difficulties that usually beset the early stages of such developments. In other words, someone is paying the price for a premature announcement and the launching of an ill-advised sales campaign.

The other view, and we regard is as the more likely of the two, is that a rather clever game is being directed from the Ludwigshafen side of the Rhine. Having made the first move and established his position, the methanol synthesist can sit by and await developments. He appreciates that further exports to the United States at this time in any large quantity would merely fan the flame of tariff agitation and possibly result in an immediate reprisal in the form of an increased duty.

There is still another reason why the German manufacturer is not yet ready to begin a price war with the American wood chemical industry. It is well known that some time ago Badische made a domestic marketing arrangement with the German wood distillation industry representing by the Holzverkohlungsindustrie A. G. As long as this contract is in effect synthetic methanol will not be sold in Germany at a price that will put the German wood distiller out of business. For the American industry the comforting part of this arrangement is that under the provisions of our anti-dumping law, the German manufacturer is not allowed to sell his products in this country at lower prices than obtained in his own. It is apparent, therefore, that as long as the sales arrangement is maintained with the German wood distillation industry, the American methanol producer is protected to some extent against a disastrous price war. This does not necessarily mean, however, that the American manufacturer is not justified in asking for additional tariff protection until such a time as the synthetic process is satisfactorily developed in this country.

For the American wood chemical industry as a whole, 1925 was one of the most discouraging years in its history in spite of the fact that the alcohol and plastics industries have greatly increased the demand for certain wood chemicals. Such an unfavorable trend prompts the natural question of the future of the domestic industry. The answer is not easily forthcoming, but developments of the past few years make it certain that at least a part of the industry is organized to withstand even a most severe competition with synthetic methanol and acetic acid. Particularly is this true of the more modern and efficient plants that are equipped to distill waste wood such as that resulting from furniture manufacture, or the making of automobile bodies as is the case with the Ford plant at Iron Mountain. The latter, too, has the additional advantage of being able to find a market for practically all of its products within the Ford organization.

In some parts of the country the competition with synthetic products will be keenly felt, and as a result it would not be surprising to see a considerable shifting of the production centers of the industry and rearrangement on a more efficient basis. In the meantime research and development of the new production processes must continue so that our future supplies of wood chemicals—whether of natural or synthetic origin—will come from an American rather than a foreign industry.

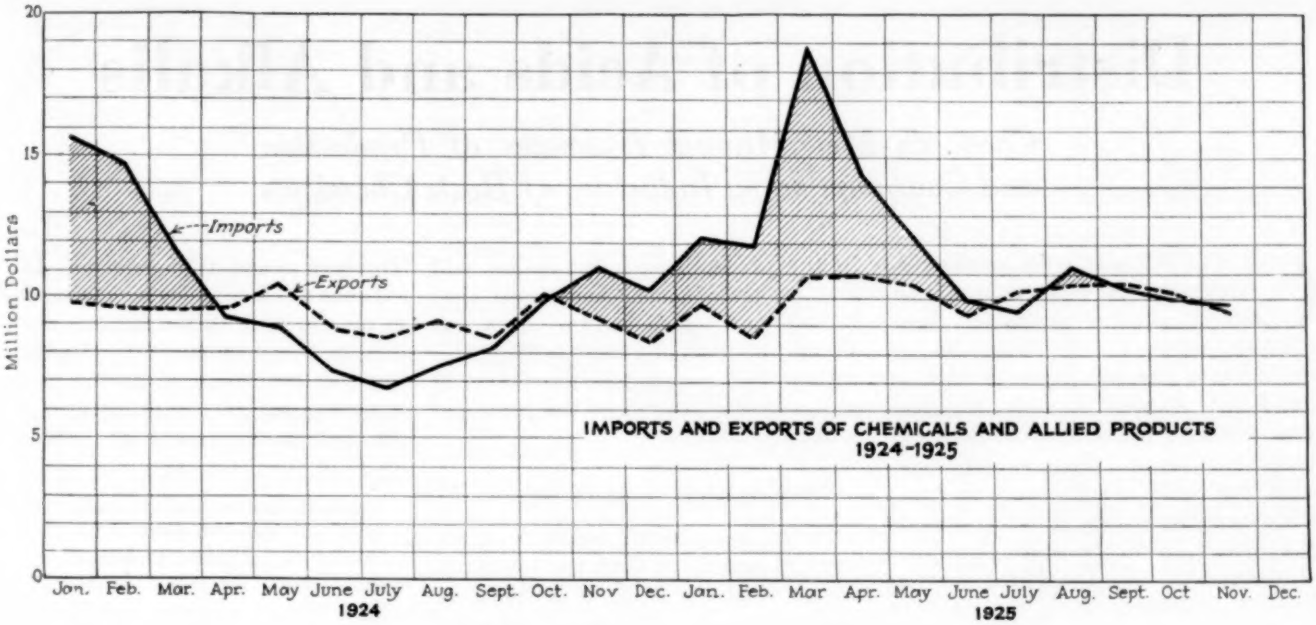
Chemical Engineering Shows Steady Advance in Pacific Coast Region

THE CHEMICAL ENGINEER has been well to the fore in plans for the conservation of timber resources in the Northwest, and the utilization of all byproducts obtainable as a result of manufacturing processes. The commercial production of oil from Port Orford cedar, at Marshfield, Ore., marked the establishment in 1925 of a new industry of promise. The paper and pulp and allied industries are steadily emerging from rule-of-thumb direction and taking their places in an orderly scheme of systematized technology. What was perhaps the most significant technical development of the year was the successful and large-scale application of economical quadruple-effect evaporation for the concentration of raw sulphite liquor and the direct production of a fluid fuel.

The outstanding feature of interest in the technology of ceramics was the development of a conditioning agent, which when added to a clay body before burning imparts increased strength and refractory qualities, as well as greater resistance to slag action and shrinkage. From the chemical standpoint its composition is similar to that of a refractory clay. Its unique physical qualities, however, obtained by special treatment, are such that by its use the strains incidental to burning are checked, and an increase in strength of the product is obtained varying from 50 to 1,000 per cent, depending on the type of ceramic body and the temperature at which it is fired.

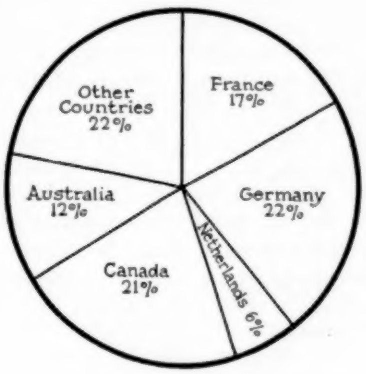
Nitrogen fixation by the arc process is an established industry at La Grande, Wash., and synthetic ammonia is being produced in Seattle. At Pittsburg, Calif., there is being constructed a small Haber-process unit for the production of anhydrous ammonia, using hydrogen that is available as a byproduct in the manufacture of electrolytic caustic. A synthetic hydrochloric acid plant was in successful operation at Pittsburg, Calif., throughout 1925, producing an average of 378 tons per month, at 92.33 per cent efficiency. The company there is also manufacturing almost the entire world output of xanthate, which has come to the fore within the last year or so because of its remarkable properties as a conditioner in the flotation process.

Manufacture of salt from sea water by solar evaporation—one of California's major chemical industries—is attracting attention; and the erection of a new refinery at Newark, Calif., was a feature of interest in 1925. Possibly as a sequel to this invasion by one of the Eastern companies, five of the leading California producers have merged, forming a combination that now controls an annual output of over 100,000 tons. The technology of potash and borax remains unchanged, although the principal company is still concerned with the results of immediate research and the prospect of improving evaporator efficiency.

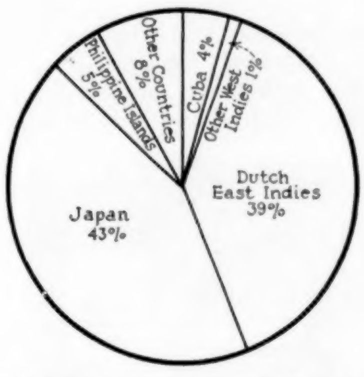


Foreign Trade in Chemicals in 1925

Imports of Dyes and Colors
Total quantity .....4,954,255 lb.
Total value $6,341,431

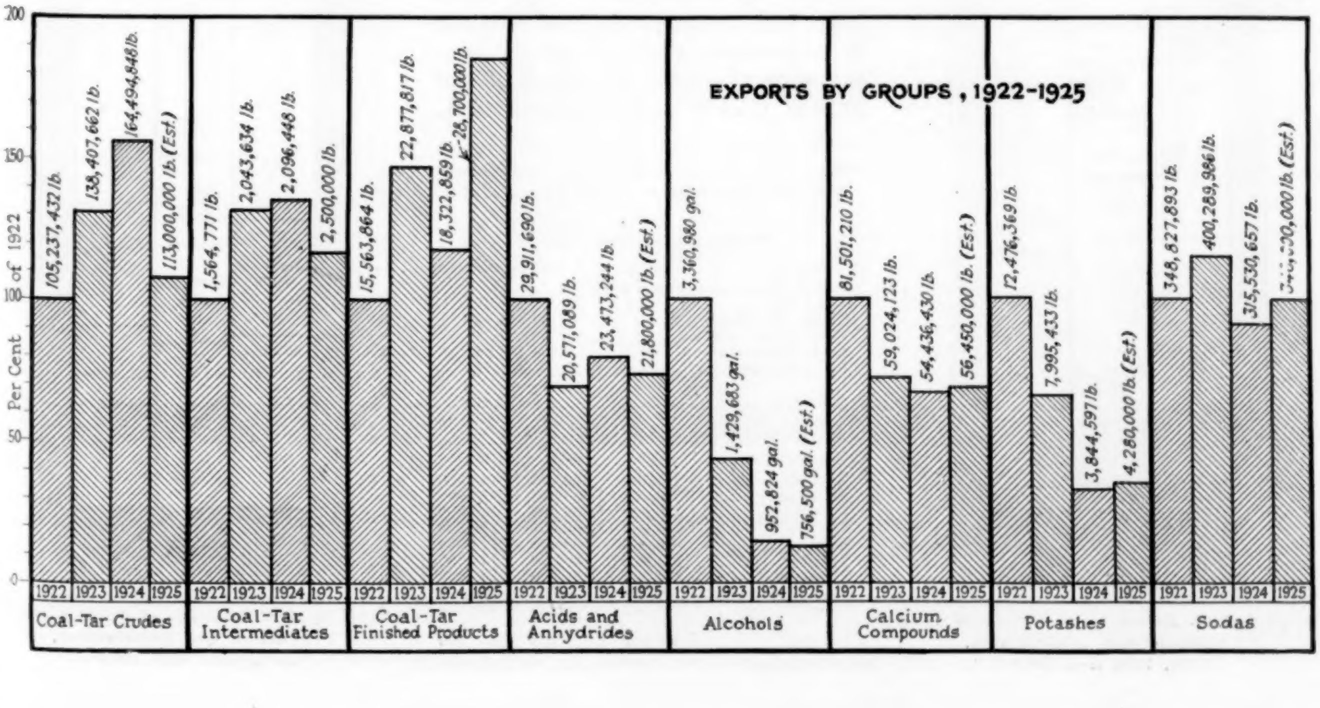


Exports of Sulphur
Total quantity .....571,225 tons
Total value $9,941,384



Sulphate of Ammonia Exports
Total quantity .....110,728 tons
Total value $6,075,832

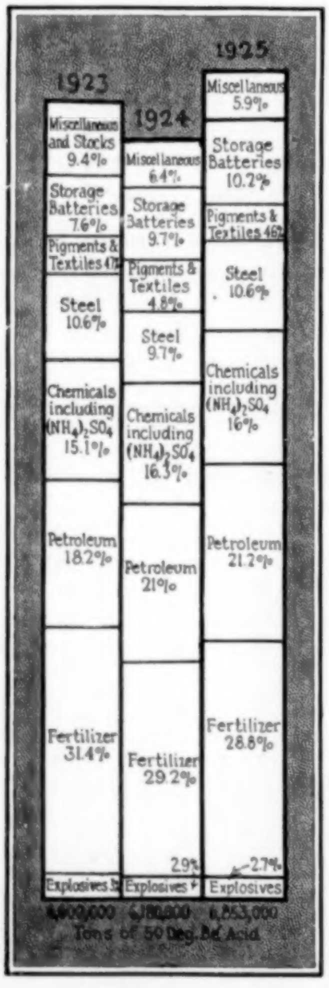
Quantities and Values Are for the 11 Months Ended November



Distribution of Acids and Alkalis

Chem. & Met. Annual Estimates of Production and Consumption by Industries of Basic Chemicals

CURRENT statistics on the distribution of chemicals by industries were practically nonexistent prior to the effort begun three years ago by *Chem. & Met.* in its First Annual Review Number. The value of these data to both the manufacturer and consumer of chemicals has been such as to warrant the extension of this effort to include practically all of the basic chemicals of commerce. In the First Annual Review Number were distribution studies of sulphuric acid, caustic soda, arsenic, bleaching powder, linseed oil, naval stores, sodium nitrate and sodium bichromate. In January, 1925, the study was extended to soda ash, industrial alcohol, lime, ammonia, cottonseed oil, oxalic acid, aniline, sulphur, and sodium silicate. In the present issue the reader will find on these pages and those that follow new distribution data on eleven additional commodities together with a continuation for 1925 of the earlier studies of the principal acids and alkalis.



Chem. & Met. Estimate of Sulphuric Acid Production and Distribution, 1923, 1924 and 1925

Sulphuric Acid in 1925

There is no better measure of industrial activitity than the consumption of sulphuric acid. It is therefore encouraging to note the substantial increase in production during 1925, which is estimated at 6,853,000 tons of 50 deg. acid. This is a quarter of million tons more than the output of 1923 and after correction is made for the military demands of 1918 it will be found that 1925 sets a new record for industrial consumption of sulphuric acid. The increase has been throughout practically the entire list of consuming industries although the most notable gains have been made in the fertilizer, chemical, petroleum refining and iron and steel industries.

Alkalis as Business Barometers

Caustic soda has had one of the best years in the history of the alkali industry, due principally to the phenomenal increase in certain of the consuming industries. The rapid growth in rayon production resulted in increasing that industry's consumption of caustic soda from 35,000 tons in 1924 to 49,500 tons in 1925.

Table I—Distribution of Sulphuric Acid Production and Consumption, 1923, 1924 and 1925

(In tons of 50 deg. Bé acid)

Production (Census Data)

Produced by—	1923 Production
Sulphuric, nitric and mixed acids industry	2,049,293
Chemical industry	1,926,142
Fertilizer industry	1,631,217
Explosives industry	146,938
All other industries	801,927
Total	6,555,517

Consumption (Chem. & Met. data)

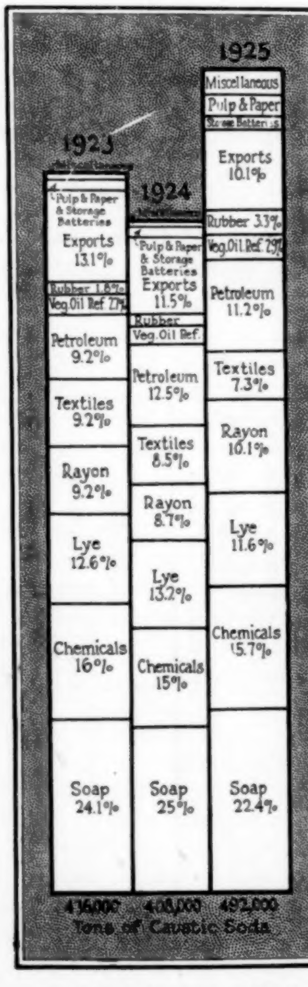
Consumed by—	1923	1924	1925
Explosives	200,000	180,000	185,000
Fertilizer	2,070,000	1,800,000	1,975,000
Petroleum	1,200,000	1,300,000	1,450,000
Chemicals	1,000,000	1,000,000	1,100,000
Steel	700,000	600,000	725,000
Textiles	112,000	100,000	118,000
Pigments	198,000	200,000	200,000
Storage batteries	500,000	600,000	700,000
Miscellaneous	620,000	400,000	400,000
Total	6,600,000	6,180,000	6,853,000

To some extent this gain was at the expense of caustic normally consumed in mercerizing cotton fabrics but the loss in this branch of textile finishing was overbalanced by the general improvement in the industry. Both the petroleum and soap industries

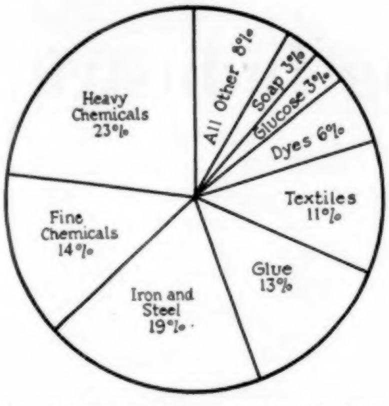
Table II—Distribution of Caustic Soda, 1923, 1924 and 1925

(Chem. & Met. Estimates)

Consumed by—	1923	1924	1925
Soap	105,000	100,000	115,000
Chemicals	70,000	60,000	75,000
Lye	55,000	53,000	57,000
Rayon	40,000	35,000	49,500
Other textiles	40,000	34,000	36,000
Petroleum	40,000	50,000	55,000
Vegetable oils	12,000	11,000	14,500
Rubber	8,000	7,000	16,000
Pulp and paper	3,000	5,000	9,000
Storage battery	2,000	3,000	5,000
Miscellaneous	4,000	4,000	15,000
Exports	57,000	46,000	50,000
Total tons	436,000	408,000	492,000



Chem. & Met. Estimate of Caustic Soda Production and Distribution, 1923, 1924 and 1925



Estimated Distribution of Hydrochloric Acid

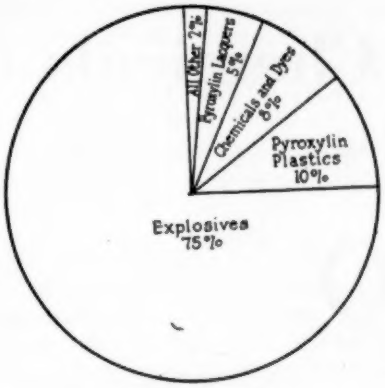
Table IV—Distribution of Nitric Acid Production and Consumption

Production (Census Data)

Produced by—	1923 Production
Explosives industry	65,595 tons
Chemical industry	33,602 tons
Sulphuric, nitric and mixed acids industry	13,919 tons
Total	113,116 tons
(On 100 per cent basis)	77,633 tons

Consumption (*Chem. & Met.* Estimates)
(On basis of 100 per cent acid)

Consumed by	1925 Consumption	Per Cent of Total
Explosives	61,000 tons	75
Pyroxylin plastics	8,250 tons	10
Chemicals and dyes	6,000 tons	8
Pyroxylin lacquers	3,750 tons	5
All other	1,800 tons	2
Total	80,800 tons	100 per cent



Estimated Distribution of Nitric Acid

showed 10 per cent increases in the consumption of caustic soda.

By far the most notable increase has been in the reclaiming of rubber due, of course, to the very high level of prices during the past year. It is estimated this gain in use of caustic soda amounted to 128 per cent over the 1924 consumption.

Soda ash, from a tonnage viewpoint second only to sulphuric acid among the heavy chemicals, showed an important increase in consumption during 1925. A part of this was accounted for by the greater output of caustic soda from the ammonia-soda process. More spectacular gains were those of the soap and the pulp and paper industries. In the latter industry the de-inking of book paper requires approximately 160 lb. of soda ash per ton of stock.

Hydrochloric and Nitric Acids

Hydrochloric acid is one of the most widely distributed chemicals and its consumption is therefore difficult to ascertain. The estimates shown in the diagram on this page are based on as reliable information as can be obtained from producing and consuming sources.

In the case of nitric acid some information on both production and consumption is available from the Census (See Table IV). Due to the overlapping of the explosives and pyroxylin industries, however, the division in consumption is not easily ascertained. For the nitrocellulose industries it has been calculated on the basis of allowing approximately 1.2 lb. of nitric acid per pound of nitrocellulose.

What Becomes of Acetic Acid

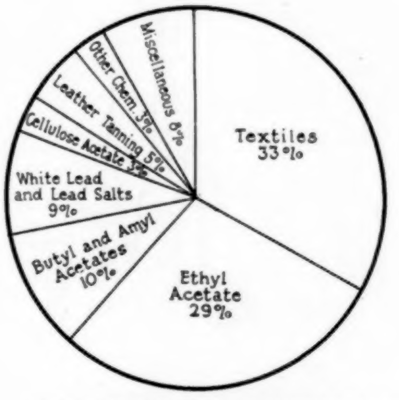
It is estimated that the equivalent of 30,000 tons of 100 per cent acetic acid were produced for industrial consumption in 1925. At least a third of this quantity was used in textile dyeing and finishing. Even a larger amount was consumed in making the organic acetates largely used as solvents. Other uses are shown in the table and chart that accompany this article.

White lead, made by the old Dutch process, is sometimes referred to as one of the largest uses for acetic acid. As a matter of fact, however, the acetic acid is a catalyst in that it is regenerated during the reaction and a comparatively small amount is sufficient to bring about a large production. The best estimate of those in the industry is that approximately 19 lb. of 56 per cent acid are required per ton of white lead. Since the total output of the pigment is less than 200,000 tons this use would account for a maximum of 1,000 tons of 100 per cent acid.

Table III—Distribution of Soda Ash, 1924 and 1925

(Chem. & Met. Estimates)

Consumed by	1924	1925
Glassworks	510,000	520,000
Soap	130,000	155,000
Pulp and paper	60,000	75,000
Textiles	30,000	35,000
Petroleum	20,000	25,000
Water softening	75,000	75,000
Cleansing compound and modified sodas	75,000	100,000
Caustic soda	417,000	465,000
Bicarbonate of soda	99,000	100,000
Other chemicals	160,000	185,000
Exports	14,000	16,000
Miscellaneous	46,000	59,000
Total tons	1,636,000	1,810,000



Estimated Distribution of Acetic Acid

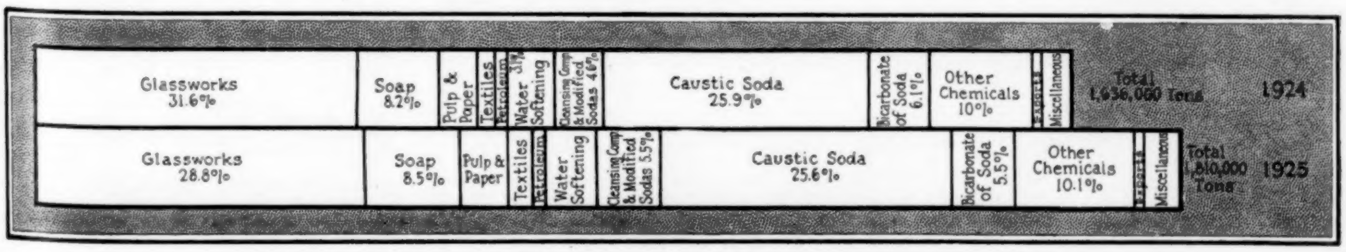
Table V—Distribution of Acetic Acid Production and Consumption

Production (Census data)

Dilute—	
Total production, 1923	14,735 tons
For sale	14,016 tons
Value	$876,864
Glacial and anhydride (mostly glacial)	
Total production, 1923	16,332 tons
For sale	14,809 tons
Value	$3,277,974

Consumption (*Chem. & Met.* Estimates)
(On basis of 100 per cent acid)

Consumed by—	1925 Consumption	Per Cent of Total
Textile dyeing and finishing	10,000 tons	33
Ethyl acetate	8,700 tons	29
Butyl and Amyl acetates	3,200 tons	10
White lead and lead compounds	2,550 tons	9
Cellulose acetate (film and rayon)	800 tons	3
Leather tanning	1,500 tons	5
Chemicals and dyes	1,000 tons	3
Miscellaneous	2,250 tons	8
Total	30,000 tons	100



Chem. & Met. Estimate of Soda Ash Production and Distribution, 1924 and 1925

Chemicals in the Consuming Industries

Compilation of Data from Various Sources Showing Industrial Comsumption of Chemical Raw Materials

QUANTITATIVE information on the consumption requirements of the various industries is of more value to the chemical manufacturer than are the usual statistics of production. To translate the latter figures into terms of consumption requires an accurate knowledge of manufacturing which is not easily obtainable. Furthermore changes in process or the shifting from one raw material to another will sometimes entirely upset such a calculation.

Recognizing the greater utility of such statistics the Bureau of the Census has always included in the schedules sent to manufacturers the request for certain information of this sort. Unfortunately, however, these requests have been limited to a very few commodities and in the expansion of the Bureau's activities since 1919 there has been a noticeable tendency further to curtail the work in this direction. Presumably this is being done in order to provide a greater detail of production statistics, compiled at more frequent intervals and therefore of greater current significance. When the Census of Manufactures was changed to a biennial basis in 1921 practically all requests for consumption statistics were abandoned or postponed until a later survey. The 1919 Census is, therefore, the last to include information of this type. It is to be hoped that the 1925 Census, which is now being taken, will not only bring these figures up-to-date but will extend them to include other important raw materials.

TABLE I—CENSUS DATA ON PRINCIPAL CHEMICALS PURCHASED AND USED BY THE CHEMICAL INDUSTRY, 1914, 1919 AND 1923

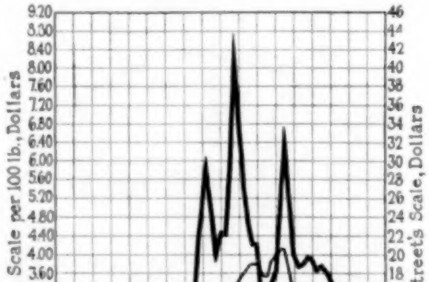
(Ton, 2,000 pounds)

	1923	1919	1914
Sulphur:			
Tons	578,100	263,256	56,296
Cost	$9,982,067	$6,062,915	$1,162,632
Pyrites:			
Tons	471,146	695,974	889,695
Cost	$1,991,954	$4,381,185	$3,769,467
Nitrate of soda:			
Tons	114,395	78,810	58,101
Cost	$6,078,455	$5,331,440	$2,696,172
Sulphuric acid:			
Tons	[1] 458,546	452,445	164,774
Cost	$3,372,866	$4,933,900	$1,515,982
Nitric acid:			
Tons	4,961	9,340	7,819
Cost	$536,160	$689,713	$641,405
Mixed acid:			
Tons	39,584	28,971	6,015
Cost	$2,263,526	$2,921,882	$698,664
Ammonium sulphate:			
Tons	1,521	4,366	9,586
Cost	$103,811	$368 222	$567,249
Alcohol, ethyl:			
Gallons	32,813		
Cost	$156,759		
Alcohol, denatured:		$950,438	$145,066
Gallons	8,141,853		
Cost	$2,267,853		
Methanol (wood alcohol):			
Gallons	2,310,399	2,888,786	1,464,273
Cost	$2,416,083	$3,631,183	$577,122
Calcium carbide:			
Tons	54,558		
Cost	$4,384,598		
Acetone:			
Pounds	1,674,000	[2]	[2]
Cost	$348,614		
Sodium compds:			
Cost	$12,848,011		

(1) Basis, 50 deg. Baumé, 446,522 tons.
(2) No data.

TABLE II—MATERIALS CONSUMED BY FERTILIZER INDUSTRY, 1914 AND 1919

Materials	1914 Tons	1919 Tons
Superphosphate		
Purchased	1,096,178	1,200,182
Made and used	2,723,317	3,316,486
Basic slag	16,190	11,394
Guano	120,128	33,053
Kainite	448,885	31,145
Potassium chloride	177,372	32,900
Potassium nitrate	507	11,751
Potassium sulphate	39,232	79,482
Double-manure salts	108,580	17,560
Other potash salts	204,282	133,299
Hardwood ashes	4,437	9,085
Cottonseed meal	325,234	230,526
Tankage, etc	887,934	689,753
Fish	250,110	273,252
Ammonium sulphate	149,924	135,882
Cyanamide	25,911	16,926
Sodium nitrate	162,184	152,415
Phosphate rock	2,080,961	2,247,325
Bone discard	3,395	12,769
Raw bones	64,590	81,304
Steamed bones	55,067	59,229
Ground bone, raw	25,139	16,471
Pyrites	613,842	398,602
Sulphur	2,041	221,558
Sulphuric acid		
Purchased	728,889	636,632
Made and used	1,276,715	1,568,577



What Was the Pre-War Price of Caustic Soda?

Government and other statistical agencies often use the years 1913 and 1914 as pre-war norms for commodity prices. In the case of caustic soda, however, such a basis of comparison is unsatisfactory because prices in 1913 and 1914 were abnormally low due to a peculiar competitive situation within the industry at that time. It will be observed from the accompanying chart that 1913-1914 marked the lowest caustic soda prices at any time since 1908.

CONSUMPTION OF CHEMICALS

Chemicals fall into the class of raw materials that are used by many industries and their distribution is, therefore, not easily ascertained. The compilation of consumption statistics for chemicals is further complicated by the varying grades and concentrations in which these materials are sold as well as the wide use of trade names for special preparations of secret composition. Doubtless these are some of the reasons why the Census has included relatively little information on the chemical requirements of the principal consuming industries. The meager consumption statistics for chemicals in these industries which have been collected by the Census are brought together in the tables that appear on these two pages.

The chemical industry is one of the largest consumers of its own products and the materials shown in Table I are obviously only a few of the many that are used by this industry. Furthermore the Census

TABLE III—CENSUS DATA ON CONSUMPTION OF CHEMICALS IN TEXTILE INDUSTRIES, 1914 AND 1919

	1919	1914
Cotton Manufactures		
Total cost of materials	$1,314,901,542	$443,522,515
Chemicals and dyestuffs	13,073,488	5,769,235
Starch	5,579,310	2,629,558
Knit Goods		
Total cost of materials	427,095,570	146,687,458
Chemicals and dyestuffs	8,222,817	2,913,027
Woolen and Worsted Goods		
Total cost of materials	665,594,683	246,496,666
Chemicals and dyestuffs	22,870,502	8,536,232
Carpets and Rugs		
Total cost of materials	67,118,039	42,280,223
Chemicals and dyestuffs	2,917,202	1,378,509
Felt Goods		
Total cost of materials	22,780,775	8,308,201
Chemicals and dyestuffs	604,616	269,927
Wool-felt Hats		
Total cost of materials	3,699,822	978,339
Chemicals and dyestuffs	172,320	34,501
Wool Shoddy		
Total cost of materials	16,076,315	5,299,903
Chemicals and dyestuffs	489,967	103,849
Fur-felt Hats		
Total cost of materials	40,158,019	16,947,058
Chemicals and dyestuffs	820,577	432,161
Dyeing and Finishing of Textiles		
Total cost of materials	174,742,815	56,705,135
Principal materials*	164,314,521	....

*According to census report "made up chiefly of Chemicals and Dyestuffs."

classification for "Chemicals" is more limited than the term generally implies. It includes the ten groups: I. Acids, II. Nitrogen compounds, III. Sodium compounds, IV. Potassium compounds, V. Aluminum compounds, VI. Bleaching compounds, VII. Coal-tar products, VIII. Plastics, IX. Compressed and liquefied gases and X. Miscellaneous organic and inorganic chemicals. Explosives, fertilizers and wood distillation products are some of the industries excepted from the census classification.

TABLE IV—CENSUS DATA ON CONSUMPTION OF CHEMICALS IN LEATHER INDUSTRIES, 1914 AND 1919

	1919	1914
Leather, Tanned, Curried, and Finished		
Total cost of materials	$647,339,238	$289,807,774
Tanning materials		
Vegetable, cost	46,616,202	44,759,117
Fats, oils and greases, cost	11,342,269	
Chemicals, total cost	20,985,006	
Acids	1,835,955	....
Alkalis	3,460,302	....
Chromates	3,082,915	....
Dyes	5,249,361	....
Other chemicals	7,356,473	....

The textile industries are probably the largest consumers of chemicals yet the Census lumps the entire consumption under the single heading "Chemicals and Dyestuffs." In 1919 for the textile industries shown in Table III this classification totals $213,000,000, which represents approximately a third of the total value

TABLE V—CENSUS DATA ON CONSUMPTION OF CHEMICALS IN PULP AND PAPER INDUSTRIES, 1914 AND 1919

	1919	1914
Total cost of materials	$467,482,637	$213,181,286
China Clay		
Tons	252,533	....
Cost	$4,421,157	....
Bleaching Powder		
Tons	139,914	....
Cost	$5,647,952	....
Sulphur		
Tons	187,794	136,458
Cost	$5,014,736	$3,134,699

TABLE VI—CENSUS DATA ON MATERIALS CONSUMED BY PAINT AND VARNISH INDUSTRIES, 1919

	Quantity	Cost
Total cost of materials	....	$223,091,742
Pig lead, tons	192,558	22,159,573
Grain alcohol, gal	2,985,735	1,724,112
Methanol, gal	244,561	303,998
Linseed oil, gal	27,037,192	43,721,595
China wood oil, gal	6,196,134	10,254,039
Cottonseed oil, gal	16,506	2 ,028
Corn oil, gal	55,074	76,739
Soya-bean oil, gal	2,753,173	3,630,634
Other oils, gal	8,749,494	3,373,988
Benzol, gal	1,665,605	400,162
Turpentine, gal	6,081,902	6,961,982
Rosin, lb	85,917,127	5,411,192
Copal, damar, Kauri, lb.	18,235,774	3,250,165
Shellac, lb	7,785,319	4,653,619
Other gums, lb	17,116,381	1,873,210

for all chemicals and dyestuffs produced in 1919. It is most apparent that more detailed statistics for the chemical requirements of the textile industries are badly needed.

The compilation in Table VIII is merely the bringing together from other sections of this Annual Review Number, the various estimates on the distribution of chemicals by industries during 1925. It should be pointed out that these statistics are not directly comparable with the

TABLE VII—CENSUS DATA ON MATERIALS CONSUMED BY SOAP INDUSTRY, 1919

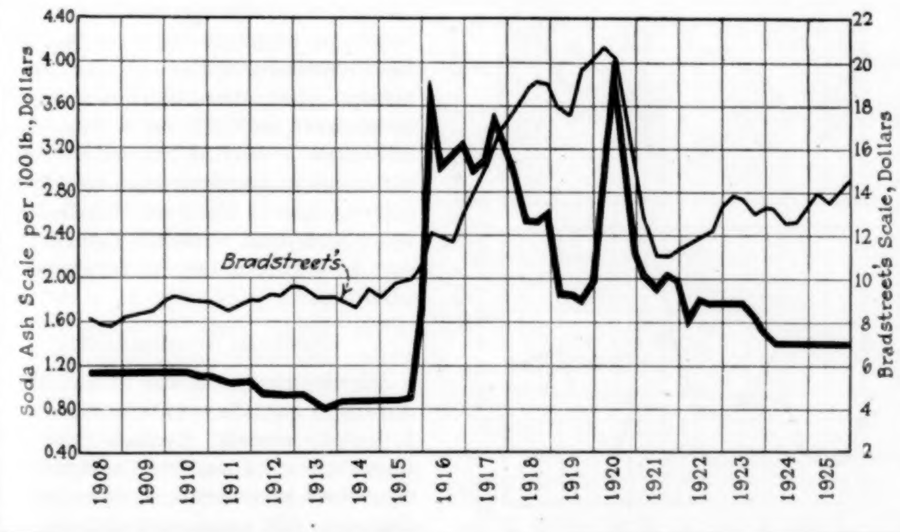
	Quantity	Cost
Total cost of materials	....	$238,518,858
Animal fats, and greases, lb	406,411,643	54,985,298
Oleic acid, gal	3,227,386	2,598,366
Other fatty acids, gal	4,087,087	3,059,407
Vegetable oils, gal		
Cocoanut	24,349,831	28,217,738
Palm-kernel	606,807	691,962
Cottonseed	7,483,977	8,274,155
Castor	362,746	463,745
Corn	298,118	341,087
Linseed	38,785	55,962
Olive	124,644	264,896
Palm	2,302,463	2,415,798
Peanut	407,359	506,490
Soya-bean	7,786,746	8,082,380
All other	....	1,163,617
Rosin, lb	119,529,661	7,836,738
Caustic soda, tons	80,279	5,700,421
Soda ash, tons	92,219	3,390,866
Hydrogenated oils, lb	17,316,625	1,765,895
Sodium silicate, tons	106,087	2,041,784
Caustic potash, tons	1,543	605,505
Borax, tons	930	129,470
Talc, etc., tons	42,708	677,215

Census data of the preceding tables because of the difference in classification and the fact that the *Chem. & Met.* figures refer to 1925 rather than 1919 or 1923.

Census consumption data for the fertilizer, paint and varnish and soap industries are the nearest approach to the sort of compilation that the chemical manufacturer would like to have for all of the consuming industries. It will be noted that information is given for both quantity and value of materials and the classifications are for the most part sufficiently definite to be of value to the producer and distributor of chemicals.

TABLE VIII—*CHFM. & MET.* DATA ON CONSUMPTION OF CHEMICALS DURING 1925

	Quantity
Chemical Indust.y	
Sulphuric acid (tons of 50 deg. acid)	1,100.000
Nitric acid (tons of 100%)	6.000
Hydrochloiic acid (tons)	30,000
Acetic acid (tons of 100%)	1,000
Oxalic acid (lb.)	600,000
Caust c soda (tons)	75,000
Refined Methanol (gal.)	800,000
Aluminum sulphate (tons)	10,000
Ammonia compounds (tons of N_2)	5,000
Lime (tons)	1,600,000
Sulphur (tons)	470,000
Soda ash (tons)	185.000
Sodium nitrate (tons)	350,000
Fert.lizer Industry	
Sulphuric acid (tons of 50 deg. acid)	1,975,000
Acid phosphate (tons of 16% A.P.A.)	3,500,000
Ammonium sulphate (tons)	250,000
Sodium nitrate (tons)	650,000
Textile Industry	
Sulphuric acid (tons of 50 deg. acid)	118,000
Hydrochloric acid (tons)	9,000
Acetic acid (tons of 100% acid)	10,000
Caustic soda (tons)	36,000
Liquid Chlorine (tons)	10,000
Soda ash (tons)	35,000
Oxalic acid (lb.)	450,000
Pulp and Paper Industries	
Sulphur (tons)	350,000
Soda ash (tons)	75,000
Caustic soda (tons)	9,000
Liquid Chloiine (tons)	40,000
Aluminum sulphate (tons)	80,000
Lime (tons)	280,000
Casein (tons)	10,000
Paint and Varnish Industries	
Linseed oil (gal.)	63,000,000
Rosin (500 lb. bbl.)	225,000
Turpentine (gal.)	6,250,000
Turpentine thinner (gal.)	4,750,000
Methanol (gal.)	500,000



Soda Ash as a Business Barometer

Comparing soda ash prices since 1908 with Bradstreet's index for all commodities, the accompanying chart prepared by the Mathieson Alkali Works shows several interesting trends. It will be noted that the soda ash curve except for a brief period in 1916-17 is consistently beneath that of the general index and that since 1921 there has been a notable divergence as ash prices have fallen while those for all commodities have steadily climbed. The present spread between the two curves is greater than at any time since 1919.

Synthetic Chemicals Gain Prominence

Offerings of Synthetic Ammonia and Methanol Were On the Market in Commercial Quantities

OUTSTANDING in importance in the chemical industry of the past year was the appearance on the market of synthetic chemicals, notably ammonia products of domestic origin and methanol produced in Germany. While these chemicals had the immediate effect of offering new competition and of disturbing market values, greater importance was attached to the significance which they carried as pointing out the progress made in chemical manufacture.

Synthetic methanol had been mentioned in the latter part of 1924 and rumors of sales to this country had been current. In the early part of last year, arrivals from Germany began to take on sizable proportions and it became evident that competition might be expected inasmuch as sales were made at prices lower than were prevailing for the wood distillation product. As the year advanced the threatened invasion of foreign-made methanol failed to materialize and a feeling of uncertainty arose regarding production costs abroad and the surplus which foreign producers would be able to offer for export. A report from abroad at the close of the year stated that production of methanol in Germany had been discontinued temporarily because of the large stocks which had accumulated at the works.

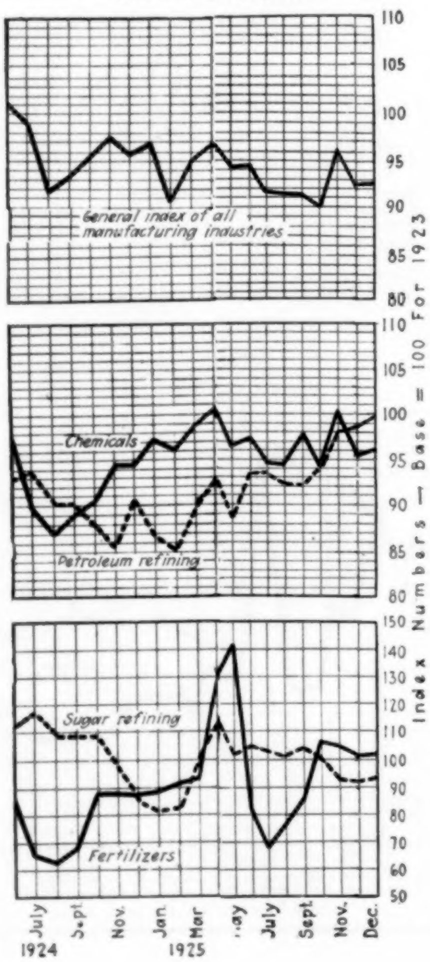
Synthetic ammonia, both aqua and anhydrous, assumed a more definite position and left no room for doubt about its commercial importance. As is usual in marketing a new product, sales were made through price concessions and the struggle between the new and old groups of producers resulted in selling pressure which disregarded production costs. This condition existed throughout the second half of the year with no indication of abatement at the close of the period. As the production of synthetic ammonia promises to be large in the present year, it is evident that it will exert more than a temporary influence on the market and that its commercial manufacture was one of the leading features of the chemical industry in 1925.

Progress also was reported in the synthetic manufacture of acetic acid although this did not reach any real commercial development as far as domestic markets were concerned. The possibility of future production, however, was apparent and this branch of the chemical industry soon may be forced to go through a period of readjustment.

Larger Production of Chemicals

Unofficial reports credit manufacturing production in 1925 as the largest in the history of the country. These reports further state that there was an increasing rate of production per employee, thus indicating greater efficiency in the various industries. While production of chemicals was not as large relatively as that for industry as a whole, there is sufficient evidence at hand to warrant the statement the output was larger than that for 1924. Trade statistics reveal that the movement of sulphuric acid was approximately 11 per cent larger than in the preceding year. Producers of caustic soda reported a gain of 22½ per cent in production of that basic chemical. For soda ash an increase of more than 10 per cent was reported.

Index of Employment



On a basis of employment figures as compiled by the Department of Commerce, enlarged manufacturing operations were the rule in the industries which are the largest consumers of chemicals. The following figures represent the average monthly index of employment for eight of the largest consuming trades, together with comparisons for 1924, the figures covering the 11 months ended November:

	1925	1924
January	92.4	93.4
February	96.1	97.7
March	101.6	96.3
April	103.8	99.4
May	93.9	91.9
June	91.6	87.3
July	92.7	83.5
August	94.7	84.7
September	98.6	90.3
October	99.3	91.5
November	98.7	91.4
General average	104.8	91.6

With the exception of January and February, the index of employment averages more in every month of 1925 than for the corresponding period of 1924. The general average for the 11-month period is about 14.4 per cent larger than for 1924. Assuming that consumption of chemicals in these industries increased in the same proportion a gain of nearly 15 per cent would be recorded. This harmonizes with private reports that manufacture of chemicals increased 15 per cent during the year. The index of employment for chemicals in November stood at 191 and demonstrated that manufacturing operations were holding on a high level although a decline in activities is expected to be shown in the forthcoming figures for December but this is regarded as seasonal rather than due to any change in fundamental conditions.

Foreign Agreements

Developments in the chemical industry in outside countries have been followed closely because of the importance of many foreign-made chemicals in domestic consuming industries. Of prime interest was the agreement entered into last May by

Chem. & Met. Weighted Index of Chemical Prices

Base = 100 for 1913-14

This month	113.86
Last month	113.11
January, 1925	113.45
January, 1924	120.08

Higher prices for acetate of lime, acetic acid, nitrate of soda and salt cake had a bullish effect on the weighted index number and brought about an advance despite lower prices for miscellaneous chemicals.

French and German potash producers. This had for its purpose the allotment of the potash markets of the world and the division granted Germany 70 per cent of the consuming requirement and France 30 per cent. The three leading German producers of tartaric acid also consolidated their sales organizations in the latter part of the year in order to maintain closer control of distribution and prices. The German bromine convention was dissolved during the year and was succeeded by a syndicate through which production will be allocated among certain potash works.

The most important merger, however, was found in that affecting six of the leading companies of the German dye cartel. In substance it means a consolidation of these companies under a single management. A carefully worked out plan has been adopted involving production and distribution, through which competition will be eliminated and economies in plant operations and in distribution will be effected. The newly created company represents the largest capital concentration of any single industrial enterprise in Germany.

Bromine Complications

In the early part of the year prospects were favorable for wide expansion in production of bromine. Producers of anti-knock gasoline was using tetra-ethyl-lead in large quantities and the call for bromides increased accordingly. In order to take care of the larger consumption every effort was made to enlarge the output of bromine. Domestic producers were spurred to action by the promise of a receptive market for all the bromine they could offer. German producers likewise were stimulated to increase their offerings by the placement of large contract orders for delivery to this country.

Deliveries of bromine to consumers, for a time involved unusually large quantities and the market appeared to be established on a higher level of operations. Late in the Spring complications set in, following agitation against the production and sale of gasoline containing tetra-ethyl-lead. Objections were raised because of alleged poisonous effects of this gasoline and the question became so acute that producers voluntarily ceased its public sale.

The bromine situation furnished the motive for an interesting experiment in chemical manufacture. A vessel was equipped with the necessary machinery to extract bromine from salt water and became a floating factory for the purpose of obtaining bromine from the ocean. The vessel made an experimental trip and the results in the way of bromine production were reported to have been entirely satisfactory. Unfortunately this happened at the time when demand for bromine had ceased and the floating factory was not put into actual operation.

Slight Decline in Prices

Although there were many changes in the price positions of individual chemicals, the more important materials were marked by a steadiness in tone and the weighted index number, based on relative values for twenty-five of the most important selections, showed very little change between the opening and closing levels. The net change for the year was slightly downward, the index number standing at 113.45 in January and 113.11. The lowest point was reached in July when the index number was 110.97 and the high point of 113.63 was attained in February.

Among the more important price fluctuations was the rise in values for sulphur. Production was on a larger scale than in 1924 but shipments, which may be regarded as

Chem. & Met. Weighted Index of Prices for Oils and Fats

Base = 100 for 1913-14

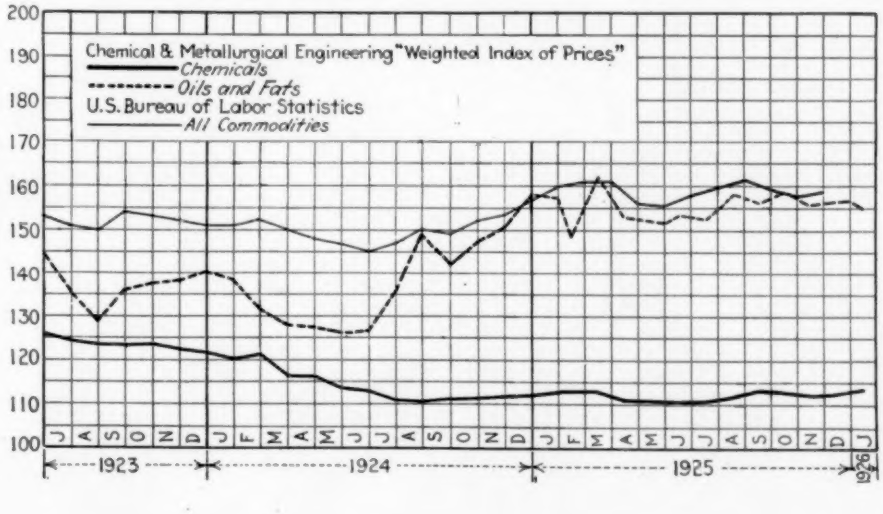
This month	154.79
Last month	156.13
January, 1925	158.02
January, 1924	138.39

Strength in crude cottonseed oil was more than offset by lower prices for lindseed oil, red oil, tallow and sulphur oil and the weighted index number was lowered during the month.

indicative of consumption, were in excess of production and surplus stocks were called on to make up the deficiency. Higher prices also were applied to bleaching powder but this action was attributed to higher production costs resulting from a lessened production. The decline in consumption of bleaching powder was represented by a corresponding gain in demand for liquid chlorine.

The entrance of synthetic methanol had a depressing effect on values for the domestic product but the most notable fall in prices followed the activity of sellers to secure business in aqua ammonia and anhydrous ammonia with a lesser effect on other ammonia compounds. Arsenic and calcium arsenate were weak throughout the year and in each case unsold stocks at the end of the year were abnormally large and indicated the improbability of any immediate recovery in values.

The weighted index number for oils and fats moved more irregularly than that for chemicals but closed under the opening level. Lower prices for linseed and cottonseed oils were a determining factor in lowering the number. Oils were at the highest point in March when the index number registered 161.32 and the lowest level was in February when the index number declined to 148.33.



Smaller Production of White Arsenic

Producers of arsenic were less active in the past year and the output failed to keep up with the record figures which had been reached in 1924. According to statistics furnished by producers, domestic production of white arsenic in 1924 was 20,177 short tons. Estimates for the 1925 production place the total at 11,250 short tons or a decline for the year, of approximately 44 per cent. Imports of arsenic in 1924 amounted to 8,877 short tons, which added to the home production, gave a total available supply of 29,054 tons. Official figures for 1925 importations are not yet complete but about 10,000 tons was brought in. This would give a total supply of 21,250 tons for the year.

During 1924, Japan held the premier position as shipper of arsenic to this country. Mexico and Canada also were drawn upon heavily for stocks and many other countries contributed large amounts. In 1925, Mexico became the largest source of supply and there was a marked decline in importations from other countries. Official returns give importations for the year as follows, the total for December not yet available:

IMPORTS OF WHITE ARSENIC

	1925 Lb.	1924 Lb.
January	2,165,633	1,925,486
February	1,589,132	1,545,024
March	1,749,621	2,181,900
April	1,921,120	2,048,339
May	1,305,980	2,386,871
June	3,082,833	2,072,315
July	1,751,486	1,537,902
August	821,834	570,970
September	1,315,005	678,533
October	1,715,588	1,304,872
November	....	799,443
December	....	652,341
Totals	....	17,703,996

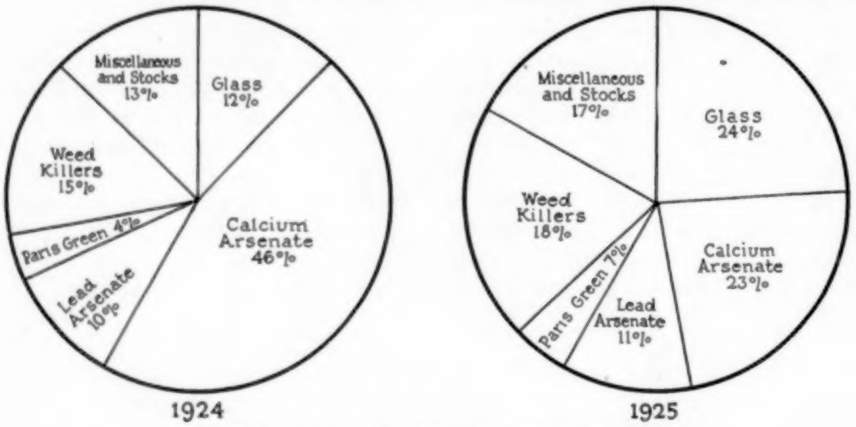
On Jan. 1, 1924, stocks of arsenic in producers possession were estimated to be 6,700 tons and on Jan. 1, 1926, this amount had increased to 8,000 tons. Assuming that stocks of imported arsenic showed but little change for the year, consumption of arsenic in 1925 would approximate 20,000 tons. The various branches of the insecticide industry offered the largest outlet but there was an increase in demand from the glass trade and a gain also was reported in the amount of arsenic used in weed killers. The fact that large supplies of arsenic and calcium arsenate were carried over from 1925 had a depressing effect on the market both as referred to production and values. As the season advanced and the arsenate situation failed to improve it became apparent that the latter industry would not be able to take up surplus arsenic stocks and at the end of the year, prospects for arsenic consumption in 1926 were rendered doubtful because of the large surplus holdings of arsenate.

The trend of market values was downward throughout the greater part of the year. Starting at a level of 6¼c. per lb., the quotations for white arsenic declined to 3c. per lb. This was entirely the result of preponderance of supply over demand and the lack of confidence which developed when it was demonstrated that consumption of calcium arsenate would not come up to expectations and that large carry-overs of stocks were inevitable. As had been the case in the preceding year, imported arsenic was the first to show weakness and generally led the way in price declines.

Domestic producers, however, were quick to meet competition and adopted a policy of issuing quotations which included delivery to plants of consumers. As a result the net prices paid for arsenic were lower than the actual quotations.

The high and low prices for white arsenic with comparisons for the last 6 years, show the following:

	High	Low		High	Low
1925..	$0.06¼	$0.03	1922..	$0.15½	$0.06
1924..	.13½	.06	1921..	.10	.05½
1923..	.16	.08¼	1920..	.16	.10



Distribution of Arsenic Into Consuming Industries

Reduced Stocks Strengthen Sulphur Values

Despite the fact that one of the largest sulphur mines was closed in 1924 and did not operate in 1925, total production during the latter year was estimated at 1,400,000 long tons or an increase of more than 14 per cent over that for 1924. With a larger call for sulphur from acid plants and from other consuming trades, deliveries from works were of greater volume than in the preceding year. Shipments to outside countries also were far in excess of the totals of previous years and in consequence, total disappearance is placed at 1,750,000 long tons. As this amount exceeds domestic consumption by about 350,000 tons, it is evident that surplus stocks were drawn on to fill orders and reserve supplies are estimated to have declined to 2,250,000 tons at the close of December.

Export buying of sulphur reached record proportions. Details, by months are shown below, with comparisons for 1924, although official figures are lacking for December:

EXPORTS OF SULPHUR

	1925 Tons	1924 Tons
January	64,527	29,684
February	31,290	32,784
March	28,825	30,922
April	47,090	29,256
May	56,134	41,495
June	49,650	58,578
July	82,791	43,606
August	45,586	27,915
September	63,845	47,527
October	64,655	70,982
November	36,651	32,614
December	......	36,451
Totals	571,225	481,814

Germany, France, Canada, and Australia were the largest outside buyers of sulphur. Exports of sulphur from Sicily were curtailed in the early part of the year because shipments in 1924 had exceeded the agreed allotment. Production of sulphur in Sicily in 1924 was 223,577 tons and 312,079 tons were exported, thus reducing stocks to 171,701 tons on Dec. 31, 1924. Sicilian production in 1925 did not differ much in volume from that reported for 1924.

Prices for sulphur compounds which had been unchanged for a long time also were advanced during the year.

The steady drain upon surplus holdings of sulphur had a strengthening effect on market values and the trend was upward with a net gain of $3 per ton for the year. The opening price was on a basis of $14 per ton at mines. This was succeeded by a quotation of $15 per ton and in the latter part of the year under the influence of heavy deliveries, the market was advanced to $17 per ton at mines or $21 per ton at New York.

Foreign Synthetic Methanol Unsettles Market

More than usual interest centered in the market for methanol in the last year. In the latter part of 1924 reports were circulated to the effect that offerings of synthetic methanol were made by producers in Germany. The accuracy of these reports were demonstrated in the early part of 1925 when arrivals at domestic ports became large enough to cause apprehension to producers in this country. The situation became further involved when rumors credited costs of production of the synthetic product to be as low as 18c. per gal. There was no doubt that prices quoted c.i.f. American ports were considerably lower than prevailing quotations for domestic methanol.

As a result of these conditions and strengthened by reports of progress in the manufacture of synthetic acetic acid, the domestic wood distillation industry seemed to be placed in a precarious position. Methanol producers offered competition by reducing their selling prices and by invoking government assistance through the medium of the flexible provisions of the Tariff act. A request also was made to prohibit importations of methanol on the grounds that it was sold in our markets at prices under those asked in German markets and therefore was subject to the regulations of anti-dumping laws. Up to the end of the year no official pronouncement had been made by the government but in the meantime imports of methanol had decreased rather than increased in volume and consular invoices showed that shipments were entered at a higher average price per lb. than had been the case earlier in the year. The prevailing duty on methanol is 12c. per gal. and the maximum increase permissable under the flexible tariff would make the duty 18c. per gal.

Production of crude methanol in this country for the 11 months, ended November, was 6,348,487 gal. or about the same as in the corresponding period of 1924. Production of refined methanol and stocks at the end of each month from April to November were as follows:

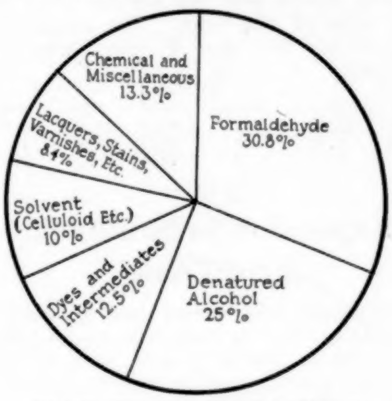
U. S. PRODUCTION REFINED METHANOL

	Production Gal	Stocks Gal.
April	474,701	717,853
May	416,227	715,000
June	375,040	669,861
July	394,207	554,261
August	525,683	575,492
September	509,195	526,176
October	671,808	515,917
November	655,541	495,492

CANADIAN PRODUCTION REFINED METHANOL

	Production Gal.	Stocks Gal.
April	36,680	68,477
May	25,800	50,344
June	17,200	51,551
July	20,700	52,459
August	....	32,007
September	21,185	40,129
October	11,500	32,443
November	39,200	40,846

While imported methanol had some effect in cutting down consumption of domestic grades, the latter supplied the greater part of requirements. The largest outlet for refined methanol was found in the manufacture of formaldehyde which accounted for 30.8 per cent of the consumption. For denaturing alcohol 25 per cent of the methanol sales was required. About 12½ per cent of sales was for dyes and intermediates, 10 per cent for solvents, 8.4 per



Distribution of Refined Methanol

cent for lacquers, stains, etc., and 13.3 per cent for miscellaneous uses.

A sharp decline was noted in the export trade which in large part was due to the competition offered by synthetic methanol. Exports, by months, for the past 2 years, were as follows, totals for December, 1925, not yet available:

EXPORTS OF METHANOL

	1925 Gal.	1924 Gal.
January	56,760	73,768
February	39,625	128,688
March	63,343	26,231
April	34,321	32,805
May	39,342	60,651
June	17,853	51,125
July	28,447	50,462
August	9,881	77,547
September	15,320	19,747
October	19,558	50,901
November	10,643	42,218
December	....	35,310
Totals	335,093	640,637

The importance of imported methanol may be inferred from the fact that in 1924 total arrivals from abroad were but 48 gal., valued at $50. Imports in 1925 were about 500,000 gal., valued at approximately $200,000. Official import figures for December have not yet been issued but imports for the 11 months ended November were as follows:

IMPORTS OF METHANOL

	Gal.	Value
January	40	$29
February	62,971	29,420
March	69,886	26,976
April	9,012	5,201
May	115,120	52,917
June	61,045	26,504
July	7,847	3,865
August	48,410	21,493
September	8,413	3,941
October	42,227	17,359
November	30,502	14,444

Increased Outlet Reported for Formaldehyde

Various consuming industries led by producers of synthetic phenolic resins are reported to have increased their requirements for formaldehyde during the past year. In 1924 the output of formaldehyde was 26,155,175 lb. with sales reported at 20,542,428 lb. Definite figures for sales in 1925 are not available but private estimates place the increase at nearly 20 per cent. Export trade played no part in the increased demand for formaldehyde as outward shipments fell below the totals for the preceding year.

Quotation for formaldehyde held a steady position throughout the year with carlots offered at 9c. per lb. On smaller amounts the price was less stable. At times small-lot buyers were able to take on stocks at the carlot figure but usually a premium was asked with an upward range on a quantity basis. The high and low prices for formaldehyde in carlots for the past six years were as follows:

	High	Low		High	Low
1925—	$0.09	$0.09	1922—	$0.16	$0.08
1924—	.11	.08¾	1921—	.16½	.10½
1923—	.16	.10¾	1920—	.85	.17

Increase in Export Trade of Zinc Oxide

One of the outstanding features in the market for zinc oxide was the sharp increase in the export trade. This was in line with the general trend in pigments, but the gain in zinc oxide shipments was much more pronounced than in the case of the other selections. A comparison of exports for the past 2 years shows the following:

EXPORTS OF ZINC OXIDE

	1925 Lb.	1924 Lb.
January	1,574,590	350,151
February	1,542,085	966,739
March	1,203,071	747,589
April	1,319,710	668,848
May	1,870,130	692,317
June	2,155,642	510,805
July	1,509,759	556,093
August	1,759,312	601,360
September	2,572,837	699,249
October	2,172,204	809,684
November	1,878,359	404,949
December	....	846,610
Totals	19,557,699	7,854,394

While no figures covering domestic production of zinc oxide for 1925 have been issued, private reports credit an increased demand in the rubber trade which industry offers the largest outlet for this product. The paint trade, which is the second largest consumer, also was active during the year and took its usual allotment. Official figures for production of paints for the first six months of the year, place the output of zinc oxide in oil at 7,297,200 lb. which compares with 5,960,000 lb. for the corresponding period of 1924.

Distribution of Zinc Oxide

Acetate of Lime Shipped in Larger Volume

On the assumption that consumption of accetate of lime is represented approximately by the amounts shipped from producing points, it becomes evident that domestic consuming requirements were larger than in 1924. Shipment figures show an increase for the year of about 6 per cent and as there was a falling off in export buying, the gain in domestic buying must have been greater than 6 per cent. According to reports from producers, production, shipments, and stocks of acetate of lime for the past 2 years compare as follows:

PRODUCTION OF ACETATE OF LIME

	1925 Lb.	1924 Lb.
January	11,589,955	13,420,193
February	10,414,270	13,172,610
March	11,372,813	14,107,411
April	11,580,597	12,650,393
May	12,269,654	11,538,625
June	10,821,839	9,396,138
July	11,448,631	7,713,750
August	11,971,359	8,112,277
September	11,114,339	8,449,457
October	11,093,858	9,803,414
November	11,201,798	10,327,102
December	....	10,317,092
Totals	124,879,113	129,008,462

SHIPMENTS OF ACETATE OF LIME

	1925 Lb.	1924 Lb.
January	10,048,474	9,022,250
February	9,611,100	8,548,032
March	10,886,087	9,027,539
April	9,182,209	12,460,054
May	12,631,276	8,561,412
June	12,811,614	9,261,158
July	10,389,589	7,056,113
August	11,402,040	11,100,905
September	12,334,945	10,024,528
October	12,224,031	12,046,811
November	12,011,964	11,698,201
December	....	9,025,604
Totals	123,533,329	117,832,607

STOCKS OF ACETATE OF LIME

	1925 Lb.	1924 Lb.
January	15,367,465	23,401,511
February	16,214,894	27,622,967
March	17,382,596	32,370,329
April	19,130,254	30,534,533
May	18,817,017	33,985,853
June	16,678,074	32,291,427
July	17,760,129	23,223,659
August	16,803,815	19,335,305
September	15,083,650	17,644,160
October	13,536,632	14,996,985
November	12,805,960	11,889,657
December	....	13,498,891

There was a marked falling off in export shipments of acetate of lime to some countries and the total to all foreign destinations also was below that for the preceding year. Exports, by months, with comparisons for 1924 follow:

EXPORTS OF ACETATE OF LIME

	1925 Lb.	1924 Lb.
January	1,994,830	326,470
February	999,374	1,118,977
March	1,097,939	1,622,341
April	1,638,526	1,420,898
May	1,815,020	3,248,745
June	1,497,608	3,183,889
July	2,457,159	3,195,825
August	1,230,614	727,709
September	1,340,490	2,462,213
October	426,219	1,367,416
November	4,570,777	3,512,131
December	....	980,145
Totals	19,068,562	23,166,759

Market prices were easy in the early part of the year and the fairly large supply in sellers possession brought about a reduction from $3.12 per 100 lb. to $2.75 per 100. In the latter part of the year demand had broadened and surplus holdings had declined and values were put back to the $3 per 100 lb. level and finally reached $3.25 per 100 lb. which was the asking price at the close of the year. The range in prices for the past 6 years was as follows:

	High	Low		High	Low
1925	$3.25	$2.75	1922	$3.50	$1.75
1924	4.00	3.00	1921	2.00	1.50
1923	4.00	3.50	1920	3.50	2.00

Expansion in Sulphuric Acid Trade

Sulphuric acid enters into so many industries that its consumption may be expected to increase in a year when general manufacturing operations are active. This condition existed last year and deliveries of sulphuric acid were far in excess of those for the 2 preceding years although not attaining the volume reached under war-time conditions. It is estimated that production of this acid in 1925 in terms of 50 deg. acid totaled 6,853,000 tons or about 17 per cent more than had been produced in 1924. The fact that the fertilizer industry was on a better footing was noticeable in the increased call for acid. Refiners of petroleum also exceeded their 1924 requirements and unusually large supplies passed to the steel and storage battery industries. The increased production of chemicals also contributed to demand for acid and larger amounts went into storage batteries.

There was an appreciable slowing up in export trade in sulphuric acid as compared with the preceding year. On the other hand imports more than doubled during the year and increased production in Canada is putting that country in a position to offer competition in domestic markets although both the import and export trade in this acid is unimportant when compared with the totals of domestic production and consumption. The import and export trade is shown in the following:

EXPORTS OF SULPHURIC ACID

	1925 Lb.	1924 Lb.
January	1,017,060	569,897
February	940,108	848,933
March	712,571	603,817
April	891,340	1,024,042
May	669,293	1,884,807
June	660,490	957,377
July	354,548	640,967
August	440,954	851,858
September	478,168	1,252,439
October	382,780	848,686
November	408,050	841,524
December	....	948,326
Totals	6,955,692	11,272,673

IMPORTS OF SULPHURIC ACID

	1925 Lb.	1924 Lb.
January	1,031,000	1,104,260
February	1,186,512	2,594,345
March	2,383,430	2,566,760
April	2,501,600	2,295,800
May	2,146,600	1,005,000
June	6,218,260	996,000
July	1,712,990	931,500
August	2,015,800	838,600
September	2,371,407	866,000
October	5,480,640	755,000
November	5,476,571	644,000
December	....	652,000
Totals	32,524,810	15,249,265

In placing contracts for 1925, consumers of sulphuric acid found considerable competition among sellers and with some business in 66 deg. acid reported as low as $10 per ton. Open asking prices during the past year ranged from $12 to $14 per ton. Advances in the market for crude sulphur gave a logical reason for a higher market for the acid. In the latter part of the year contract business for 1926 delivery was put through at varying prices with some placements reported at slightly under $11 per ton.

Metal Fluctuations Affect White Lead Values

Official compilations give production of white lead in oil in 1924 as 329,816,700 lb. These figures are included in data given for paints and varnishes with no figures to show production of dry white lead. For the first 6 months of 1925 the output of white lead in oil was reported at 154,978,500 lb. with sales of 144,141,300 lb. This compares with production of 177,259,000 lb. and sales of 163,172,600 lb. for the corresponding period of 1924. The Geological Survey, for 1923, gave production white lead in oil production, for that year, as 306,786,000 lb. and dry white lead, 82,196,000 lb., while the census figures for the same year report dry white lead at 317,136,109 lb. According to reports from manufacturers there was a steady call for white lead deliveries throughout the year but the figures would indicate that production and sales were lower than in 1924.

Market prices moved in rather close harmony with fluctuations in the market for pig lead and the up and down movement in prices for lead pigments was said to be due to variations in production costs rather than to any influence of supply and demand. Prices at times were quoted with a guarantee against declines for a stated time.

The high and low prices for dry white lead, basic carbonate, in round lots, ranged as follows in the past 2 years:

	1925		1924	
	High	Low	High	Low
January	$0.11	$0.11	$0.09¼	$0.09¼
February	.11½	.11	.09½	.09¼
March	.11¼	.11¼	.10	.09½
April	.11¼	.10¾	.10¼	.10
May	.10¾	.10¾	.10¼	.10¼
June	.10¾	.10½	.10¼	.10¼
July	.10½	.10½	.09¾	.09¾
August	.10¾	.10½	.09¾	.09¾
September	.10¾	.10½	.10	.10
October	.10¾	.10¾	.10¼	.10
November	.10¾	.10¾	.10½	.10½
December	.10¾	.10¾	.11	.11

Export trade in white lead was relatively active and showed a gain of about 40 per cent for the period. Exports, by months, compare as follows:

	1925 Lb.	1924 Lb.
January	1,363,448	962,176
February	563,128	709,001
March	921,297	656,350
April	1,060,896	472,405
May	1,025,665	290,286
June	1,539,792	907,856
July	1,846,388	700,719
August	1,404,968	739,659
September	1,234,147	364,808
October	1,032,831	1,793,551
November	725,171	1,321,074
December	....	1,191,570
Totals	12 717 631	10.109,455

Large Gain in Consumption of Caustic Soda

Consuming demand for caustic soda was on a broader scale last year and this rendered necessary an increase in output. Estimated production in 1924 was 400,000 tons and last year the output, based on trade reports, was 492,000 tons or an increase of 23 per cent for the year. A small percentage of the increase was found in the export trade but practically every domestic consuming outlet was enlarged over that for the preceding year. It is true that a smaller amount of caustic went into the mercerizing trade but the textile industry as a whole increased its requirements and a noticeable gain was registered in the manufacture of rayon. Soap makers maintained their position as the largest consumers of caustic with the chemical trade holding second place. The allotment to the rubber trade was more than doubled and larger amounts were used for oil refining than was the case in 1924.

The export outlet was broader than in the preceding year. Shipments to Mexico were unusually large and South American countries bought in a large way with the Argentine and Brazil as leaders. Canada held a place of prominence in the export movement and shipments to Japan were of large volume. The Philippine Islands, Cuba, China, and Java also bought freely throughout the year. Exports, by months with the exception of December, are given below together with comparisons for the corresponding periods of 1924:

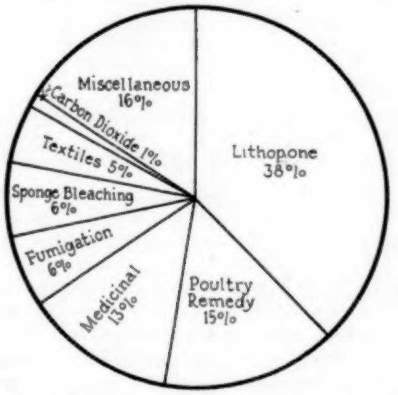
EXPORTS OF CAUSTIC SODA

	1925 Lb.	1924 Lb.
January	7,182,850	9,847,118
February	7,799,465	7,814,591
March	8,604,308	5,997,383
April	8,340,359	8,044,417
May	7,462,808	6,237,549
June	7,563,864	6,321,297
July	9,139,626	8,715,062
August	8,922,999	6,872,574
September	6,378,164	7,2(6 614
October	9,717,941	8,742,418
November	7,843,934	7,696,929
December	....	8,619,679
Totals	88,956,318	92,115,631

While open quotations for caustic soda were free from fluctuations, business went through at times on private terms with the buyer receiving concessions. Competition in foreign markets also was keen and this had an effect on the stability of c.i.f. quotations as sellers were forced to cut prices in order to keep open their outlets in foreign countries. Contract prices for 1926 were named in November and showed no change from those quoted on 1925 business. As soon as the new contract figures became operative, a large volume of business was placed for future deliveries, thus insuring a large consumption of caustic soda in the present year.

Changes in Distribution of Permanganate of Potash

While there was considerable competition between domestic and imported permanganate of potash this did not lead to the wide price fluctuations which were present in 1924. At times there were odd lots on the spot market which were pressed for sale but as a rule quotations moved within narrow scope. It is stated that a greater part of domestic requirements were filled by domestic permanganate than was the case in the preceding year. Consumption of this chemical by industries has shown considerable changes in recent years. During the war years saccharine makers were the largest buyers of permanganate but they now use bichromate instead. In some years dye manufacturers have



Distribution of Permanganate of Potash

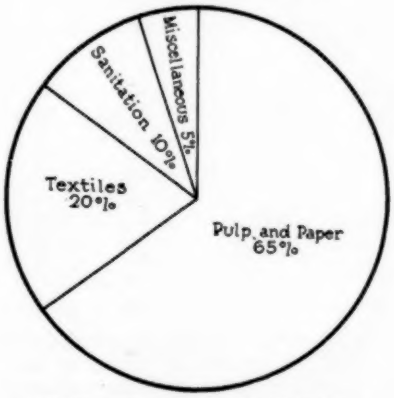
taken the major share of permanganate. Last year the place of honor was accorded to makers of lithopone who took 38 per cent of the supply. About 15 per cent was used in poultry remedies, 13 per cent in the drug trade, 6 per cent in fumigation, 6 per cent by sponge bleachers, 5 per cent by the textile trade, and 16 per cent for miscellaneous uses.

Prices for permanganate of potash opened at 14½c. per lb., reached a high of 15c. per lb. and closed at the 14½c. per lb. level. High and low prices for the past 6 years were as follows:

	High	Low		High	Low
1925	$0.15	$0.14½	1922	$0.15	$0.12
1924	.14½	.12¾	1921	.55	.12
1923	.25	.14¼	1920	.70	.55

Bleaching Powder Higher With Output Reduced

The shifting in positions between bleaching powder and liquid chlorine continued throughout the past year



Distribution of Liquid Chlorine

with a reduction in production of bleaching powder and a corresponding gain in the output of chlorine. This results from the fact that the two materials are used in the same industries and purchases of one automatically reduces purchases of the other.

The contract price for bleaching powder for 1925 delivery was maintained at $1.90 per 100 lb. throughout the year and market prices for the domestic trade were marked by the lack of changes. Export business was put through at varying prices and surplus stocks which in former years had been accustomed to bring out low prices especially in the hot weather months when it is difficult to store bleaching powder, were disposed of in foreign countries at very low prices. Some of these export sales were said to have been made at prices under $1 per 100 lb. at works. At one time there were reports that Canada had imposed emergency import tariffs in order to prevent dumping from this country.

The contact price for liquid chlorine in tanks was 4c. per lb. for 1925 and this figure was announced as the basis on which business for 1926 would be written. The price for small lot business in cylinders, however, was established on a higher level than the one which had prevailed for 1925.

Export trade in bleaching powder which had fallen off in 1924 showed a reaction and almost equaled the total for 1923. Exports for the past two years were as follows, the figures for December 1925 not included:

EXPORTS OF BLEACHING POWDER

	1925 Lb.	1924 Lb.
January	2,560,748	2,047,458
February	1,264,724	2,071,947
March	2,084,545	1,318,383
April	2,462,471	1,865,051
May	3,309,843	1,751,228
June	4,029,699	2,479,209
July	3,067,142	1,664,109
August	2,089,525	1,420,088
September	1,352,372	1,813,550
October	1,646,038	1,942,370
November	1,829,104	1,538,509
December	....	1,690,223
Totals	25,695,063	21,602,125

Large Carryover of Stocks of Calcium Arsenate

Demand for calcium arsenate from the cotton-growing states failed to come up to expectations and the industry went through another year of financial reverses. Different estimates have been heard regarding the stocks of arsenate on hand at the beginning of the year. Some members of the trade say the total was 10,000 tons and that an equal amount was on hand at the close of the year. If these figures are correct there was an even balance between actual production and consumption during the twelve months. Estimates on consumption center around 9,000 tons. This compares with a consumption of about 16,000 tons in the 1922-1923 season and demonstrates that the use of arsenate as a deterrent of boll weevil ravages has lost ground.

The falure of the arsenate trade to take advantage of potential demand is not attributed to lack of efficacy of the

poison or to the superiority of any competing product. Rather, it is held by cotton-growing interests that calcium arsenate is the only poison which has proved practical in prevention of boll weevil damage. They further state that profits from cotton have been greatly increased per acre where the growing plant was treated with arsenate. It is evident, therefore, that educational work is necessary in order to increase the outlet for arsenate and it also appears that demand is and will be variable according to the severity of boll weevil infestation. Under these conditions it is difficult prophesy what the extent of the arsenate trade will be in the coming year or to place confidence in the assertion that the industry is going backward.

Among the developments of the year was the withdrawal of the state of Georgia as a handler. For four years the state was an important factor in supplying the needs of its inhabitants. It succeeded in placing Georgia far ahead of the other states from the standpoint of consumption, but this method of distribution had a depressing effect on the industry as a whole and the situation has been improved by the withdrawal of that state as a marketing agent.

Market prices for arsenate were regarded as low at the beginning of the year when holders of stocks were offering at 8c. per lb. The weight of stocks, however, made it difficult to maintain any stability to values and more or less price cutting was in evidence throughout the year. At one time offers were free at 6c. per lb. delivered to consumer and even this figure failed to arouse any buying enthusiasm. At the close of the year, the asking price was 7c. per lb. but there was not enough business passing to test the firmness of this quotation.

Large Consumption of Soda Ash Last Year

Reports from the various trades which are consumers of soda ash indicate that there was a general broadening in activities and a corresponding increase in the amount of ash consumed. Total production of ash for the year is placed at 1,810,000 tons, a gain of nearly 11 per cent over the total for 1924. Glass makers accounted for a large part of the consumption of ash but a higher percentage of increase was registered in the caustic soda trade and in chemical manufactures. Soap makers likewise took on larger amounts than in the preceding year. A decline was reported in the use of ash in producing modified sodas but cleansing compounds in general more than made up for this loss and the total amount of ash used in modified sodas and cleansing compounds was in excess of that for 1924. Improvement in the pulp and paper trade was responsible for a 25 per cent increase in ash consumption in that direction. There was very little change in ash requirements for water softening and for the manufacture of bicarbonate of soda but moderate advances were reported for textiles and petroleum refining.

Shipments of soda ash to foreign countries were slightly larger than in 1924. The greater part of export deliveries was destined for Mexico, Canada, and Cuba. A comparison of monthly exports during 1925 and 1924 is furnished by the following but figures for December, 1925, are not included because not yet available:

EXPORTS OF SODA ASH

	1925 Lb.	1924 Lb.
January	1,523,808	1,582,554
February	2,967,346	1,803,668
March	4,911,178	2,076,300
April	2,164,958	2,132,040
May	1,809,845	1,811,960
June	2,876,950	2,326,172
July	3,760,227	2,143,970
August	1,820,143	2,841,138
September	2,413,122	3,026,045
October	2,629,971	3,474,914
November	2,567,050	3,838,019
December	....	1,626,516
Totals	29,444,598	28,683,296

Prices for soda ash as quoted by producers showed the usual ranges according to grade, package and quantity. An unchanged level of prices ruled throughout the year and contract prices for 1926 were announced late in the year and were unchanged from those which were effective in 1925 deliveries. The contract quotation for light, 58 per cent soda ash is $1.25 per 100 lb. flat, in bulk, $1.38 per lb. in bags, and $1.63 per 100 lb. in bbl. Dense ash, 58 per cent, is quoted at $1.35 per 100 lb. in bulk, $1.45 per 100 lb. in bags, and $1.69 per 100 lb. in bbl. These prices met with the approval of buyers and in the closing weeks of the year numerous contracts were placed for 1926 delivery so that a large part of the current year production is sold ahead.

Lower Average Prices for Bichromate of Potash

While the prices quoted for bichromate of potash did not vary much from the closing figures for the preceding year, the average for 1925 was lower than in 1924 and was considerably below that for the past 10 years. There was no marked change in the industry with gains in consumption in some directions offset by losses in other outlets. Export buying again fell off materially and now accounts for less than 5 per cent of production. A comparison of exports with those for 1924 shows the following, the figures for December 1925, not included:

EXPORTS OF BICHROMATE OF POTASH

	1925 Lb.	1924 Lb.
January	27,559	68,949
February	44,869	149,310
March	70,853	87,035
April	22,970	73,374
May	74,532	91,167
June	20,779	73,507
July	......	87,269
August	67,302	127,227
September	40,662	186,509
October	11,719	56,187
November	4,489	98,475
December	......	70,257
Totals	420,603	1,169,266

Values, at the beginning of the year were still under the influence of competition for contract business and round lots were offered at 8¼c. per lb. The market gradually strengthened as the season advanced and for a considerable period 8½c. per lb. was an inside price with small lots selling up to 8¾c. per lb. In the final quarter of the year, producers again became active in offering distant deliveries and contract business for 1926 was written at prices varying from 8c. to 8⅜c. per lb. depending on quantity and time of placing order. The range in prices for round lots for the past 6 years is shown below:

	High	Low		High	Low
1925..	$0.08½	$0.08	1922..	$0.10¾	$0.09¾
1924..	.09½	.08	1921..	.15	.10
1923..	.11¼	.9¼	1920..	.50	.17

Keen Competition Featured Market for Ammonia

Steadiness in prices which had characterized trading in aqua ammonia in preceding years was succeeded by drastic fluctuations in values in the latter part of 1925. This condition resulted from the presence on the market of aqua ammonia produced in synthetic ammonia plants. This new production augmented the supply and the fact that the output of synthetic ammonia will be greatly enlarged, invited the keenest kind of competition among producers to secure contract orders for delivery over 1926. According to census figures, production of aqua ammonia from coal-tar byproducts in 1923 was 67,425,904 lb. Private estimates place synthetic ammonia output in 1925 at about 13,000 tons with a probable production of twice that amount in 1926. It is difficult to establish how much of this production will be marketed as aqua ammonia but it is admitted that producers have accepted orders calling for deliveries of large quantities of this chemical. Favorable conditions among consuming industries would warrant some increase in the supply of aqua ammonia but a large surplus would be inevitable if old-established producers operate in a normal way and synthetic production approximates the prophesied totals. Further complications are found in the fact that recent sales have been on a basis below the cost of production. This has given rise to considerable speculation regarding relative production costs between the two classes of manufacturers and the consequent ability of manufacturers to meet competition over a protracted period, should the struggle for mastery of the market extend that far.

The causes which have unsettled the market for aqua ammonia also have applied in equal measure to the anhydrous product. Buyers have been able to take on stocks at almost their own figures and this has held true for distant as well as for prompt deliveries.

At the beginning of the year aqua ammonia, 26 deg. was quoted at 6½c. per lb. but under selling pressure sales were reported later as low as 3c. per lb. delivered to buyers plant. Anhydrous ammonia opened at 28c. per lb. and closed at 15c. per lb. with reports that this figure had been shaded in some transactions and in fact prices of 13c. per lb. were given as an open figure in some quarters.

Alcohol Production in the Philippine Islands

In 1924 the production of alcohol in the Philippines aggregated 2,300,000 gage gal. and estimates place 1925 as equal to or in excess of that figure. There are about 500,000 tons of sugar produced in the Philippines each year and, while the quantity of molasses per ton of sugar that results as a by-product varies, a rough average indicates that there are about 40 gal. of molasses to each ton of sugar. During 1924 approximately 248,500 gal. of 95 per cent alcohol was exported, principally to China. The value of the exports was recorded as $77,800, indicating an export price of about 30 cents per gal. In addition to that exported, about 420,000 gage gal. were consumed locally for motor fuel, particularly by sugar centrals.

Increase in Production of Denatured Alcohol

Statistics covering the production of ethyl alcohol are found in the report of the Commissioner of Internal Revenue. This report refers to the fiscal year ended June 30, 1925 and states that production for the year amounted to 166,165,517 proof gallons, as compared with 135,897,725 proof gallons for the preceding year. There was withdrawn from warehouse for tax-free purposes, including denaturing, for export, for use of the United States, hospitals, laboratories, colleges, and other educational institutions, a total of 147,729,450 proof gallons, an increase of 25,975,817 proof gallons, compared with withdrawals in the former fiscal year.

There were 81,808,273 wine gallons of denatured alcohol produced during the fiscal year, of which 46,983,969 wine gallons were completely denatured and 34,824,303 wine gallons were specially denatured, compared with 67,687,295 wine gallons of denatured alcohol produced during the previous fiscal year, of which 34,602,003 wine gallons were completely denatured and 33,085,292 wine gallons were specially denatured

The increase in the quantities of both completely and specially denatured alcohol produced during the year is attributable to the constantly increasing use of completely denatured alcohol for general purposes, such as for fuel, light, and power, and to the use of specially denatured alcohol in the manufacture of new products and articles, in the manufacture of which tax-paid alcohol has been used heretofore.

Good consuming demand and reported high costs of production caused an uplift in market prices in the first part of the year but values eased off during the hot weather with some irregularity to quotations because of the surplus stocks carried by sellers. The demand for anti-freeze purposes had a strengthening effect in the latter part of the period and the trend of values again swung upward, but large surplus stocks prevented any decided strength.

The range in prices per gal., for denatured alcohol formula No. 5, 188 proof, in bbl. is shown in the following table with comparisons for 1924 and 1923:

	1925		1924		1923	
	High	Low	High	Low	High	Low
Jan..	$0.61½	$0.61½	$0.50½	$0.50	$0.38	$0.37½
Feb..	.61½	.57½	.50½	.50	.38	.37½
Mar.	.57½	.57½	.50½	.50	.38	.37½
April	.57½	.57½	.50½	.50	.38	.37½
May	.57½	.57½	.50½	.50	.40	.37½
June.	.57½	.52½	.50½	.50	.40	.40
July.	.54½	.52½	.47½	.47	.42½	.40
Aug.	.58½	.54½	.47½	.47	.42½	.42½
Sept.	.58½	.58½	.51½	.51	.44½	.43
Oct..	.58½	.58½	.54½	.54	.46½	.44½
Nov.	.58½	.58½	.61	.60	.50½	.46½
Dec..	.58½	.58½	.61	.60	.50½	.50½

Marked Decline in Imports of Nitrite of Soda

The feature in the market for nitrite of soda was the lessening in competition from foreign markets. This may be seen from the fact that imports for the 11 months ended November were 1,189,485 lb. as compared with 4,307,440 lb. for the corresponding period of 1924. This means that domestic manufacturers have been in control of the market and that an import duty of 4½c. per lb. has discouraged foreign producers from forcing sales in this country. This is in sharp contrast to the situation in the early part of 1924 when domestic manufacturers had practically ceased operating because they could not compete with the foreign-made product. Definite figures to show the extent of domestic production are lacking but it is estimated that the total was around 6,000,000 lb. The greater part of the output was used in the manufacture of dyes.

Price fluctuations in the past year were within narrow limits. Competition was not keen enough to bring about any sustained weakness in values and asking prices were not advanced to a point which would encourage offers from abroad.

The high and low prices for the past 6 years show that the higher tariff had a strengthening effect. The prices were as follows:

	High	Low		High	Low
1925..	$0.09	$0.08⅞	1922..	$0.10	$0.06
1924..	.09½	.07⅞	1921..	.10	.06
1923..	.10	.07¼	1920..	.30	.12

Distribution of Nitre Cake

German Potash Sales Larger Last Year

Following the Franco-German potash pact, signed on May 7, 1925, at Paris, France, dividing the world market in the ratio of 30:70, production and sales by Germany were much stimulated. 1925 potash production will shade the record of 1.3 million tons of pure potash (K_2O) sold in 1922. Syndicate figures for the first 10 months of 1925 showed sales amounting to 1,108,000 tons. November sales amounted to around 50,000 tons, while December sales may have exceeded this figure.

Smaller Range of Prices for Bichromate of Soda

The various industries which are consumers of bichromate of soda were operating more actively last year than had been the case in 1924 and this is regarded as proof that production and consumption of bichromate was on a larger scale. The latest official figures available refer to 1923 production and bichromate and chromate of soda is placed at 26,879 tons. Private estimates say that 1925 production was around 29,000 tons.

The export trade in bichromate and chromate of soda was of fair volume. For the first time, the Department of Commerce included these chemicals in its monthly summaries of exports and the figures for export business show the following:

EXPORTS OF BICHROMATE OF SODA

	Lb.	Value
January	162,391	$10,474
February	758,537	45,492
March	940,982	56,754
April	649,632	38,760
May	459,042	28,272
June	525,561	31,414
July	713,209	42,565
August	530,651	33,419
September	387,005	22,962
October	655,255	41,540
November	563,332	35,023
Totals	6,335,597	$386,675

Values for bichromate of soda were steady in the early part of the year and after the majority of consumers had placed contract orders, the spot market moved upward. Later in the year, there was the customary eagerness on the part of producers to take on orders for 1926 delivery and prices became irregular with concessions given to buyers of especially large amounts. Contracts were reported to have been placed as low as 6c. per lb. and up to 6¾c. per lb.

The high and low prices for the past 6 years are given below:

	High	Low		High	Low
1925..	$0.06¾	$0.06	1922..	$0.07⅝	$0.06⅞
1924..	.07½	.06	1921..	.08⅞	.07¼
1923..	.08½	.07½	1920..	.33	.09⅞

Imports of chrome ore were about 145,000 long tons or nearly 25 per cent larger than in 1924. New Caledonia ore which formerly was used in bichromate manufacture was not in demand during 1925 as the trade has been using a high grade soft ore from Rhodesia.

Active Buying in Market for Glycerine

For a large part of the year there was strong tone to the market for glycerine because raw materials were holding up well in price and production costs were firm accordingly. In the latter part of the year demand for glycerine became unusually active and this not only served to take surplus holdings off the market but it left producers in a sold up condition and in some cases first hands were not able to take orders calling for prompt and nearby deliveries. Large contracts were placed by buyers who wanted glycerine for anti-freeze purposes and with other consumers buying in a large way the demand was difficult to meet and values responded quickly to the changed marketing conditions.

As a result export shipments were cut down in volume and for the 11 months ended November, they amounted to 1,150,678 lb. as compared with 1,334,836 lb. for the corresponding period of 1924. On the other hand, foreign markets were called on more freely for supplies and importations increased about 50 per cent during the year. Imports for the past 2 years compare as follows, the figures for December, 1925 not being included:

IMPORTS OF GLYCERINE

	1925 Lb.	1924 Lb.
January	1,511,283	497,294
February	1,497,692	1,244,734
March	2,644,915	1,155,731
April	948,583	856,008
May	969,002	872,620
June	1,548,123	647,961
July	730,152	249,918
August	1,205,648	619,968
September	1,657,947	1,369,658
October	4,656,626	3,045,598
November	1,883,554	2,791,409
December	....	2,576,802
Totals	19,276,335	15,927,701

Production of crude, 80 per cent glycerine in the past 5 years is estimated as follows:

	Lb..
1925	110,000,000
1924	101,000,000
1923	96,545,531
1922	85,337,034
1921	63,946,751

At the beginning of the year crude glycerine, basis 80 per cent, loose, was quoted at 10¾c. per lb. and at the close it was little better than nominal at 15¾c. per lb. C. P. glycerine closed at 25c. to 27c. per lb., according to seller, after holding at a 19c. pre-level for several months.

Higher Duty for Chlorate of Potash

In April a proclamation issued by the President established a higher import duty on chlorate of potash. The old duty was on a basis of 1½c. per lb. and the increase of 50 per cent as permissible under the flexible provisions of the tariff made the new duty 2¼c. per lb. In the investigation which had followed the petition for an increase in duty it had been revealed that Germany was the principal competing country and the higher duty was granted to lower the differential in producing costs between the two countries. It was stated that even the higher duty did not entirely compensate for the lower costs of operating in foreign plants. Practical evidence of this was found in the compilations of import statistics at the end of the year. The latest figures available referred to November imports and imports from Jan. 1 to Nov. 30 inclusive were found to have reached a total of 11,677,271 lb. which compares with 6,810,535 lb. for the corresponding period of 1924. These totals include both chlorate and perchlorate and while there was some increase in demand for the latter, the greater part of the total refers to chlorate and shows that foreign-made chlorate was more of a factor in domestic markets last year than had been the case in preceding years.

Prices for chlorate of potash were quoted around 8½c. per lb. at works by home producers with a range upward according to quantity. There was no attempt to advance prices after the higher duty was announced but later developments demonstrated that foreign producers had no intention of relinquishing this market and competition soon became as keen as it had been under the lower import rates.

Considerable progress was reported during the year in consumption of perchlorate of potash. This took the form of larger imports and also of an increase in domestic production. In some cases sales for import into this country were difficult to carry out because of the scarcity of stocks in foreign markets and this had a stimulating effect on the home production as some of the contracts for foreign-made perchlorate were switched to the domestic product or at least were covered by purchases of domestic perchlorate at prices higher than those named in the original contracts.

Production and Disposition of Ammonia Products

The following figures present the estimated production and disposition of ammonia and ammonium salts in the United States for the years enumerated. The figures are in terms of net tons of nitrogen:

	1923	1924	1925
Production:			
At coke ovens	115,000	109,000	128,000
At gas works	5,500	5,500	5,500
From the air	3,000	3,500	11,000
Bone distillation, etc	200	200	200
Imports as $(NH_4)_2SO_4$*	800	1,200	5,000
Totals available	124,500	119,400	149,700
Disposition			
In mixed fertilizers	40,000	46,000	52,000
Sulphate used as fertilizer	2,000	2,000	2,000
Anhydrous ammonia	13,500	13,500	15,000
Aqua ammonia	18,600	22,000	24,000
In explosives	7,200	7,200	7,500
In ammonium salts (chemicals)	5,000	5,000	5,000
Export as ammonium sulphate	34,500	26,500	26,100
Apparent increase or decrease in stocks	+3,700	−2,800	+18,100
Total disposition	124,500	119,400	149,700

* Does not include chemical imports such as ammonium chloride (containing 1,500 tons N in 1925) ammonium nitrate (containing 1,500 tons ammonia N in 1925), and miscellaneous ammonium salts (containing 300 tons N in 1925).

New Outlets Are Sought for Potassium Permanganate

Cash prizes of $200, $30 and $20 have been offered by the Carus Chemical Co., La Salle, Ill., for suggestions for new uses of potassium permanganate. The judges are Prof. O. L. Kowalke, Dept. of Chemical Engineering, University of Wisconsin, Karl Kleimenhagen, treasurer, and E. H. Carus, president of the company. Awards will be made only for practical uses tested by the proposers and found economically feasible. Certain known uses are excluded. Details of the contest, which closes Feb. 15, 1926, can be obtained from the company.

Acetic Acid Closed at High Price Levels

The position of acetate of lime was the important factor in determining the prices for the different grades of acetic acid. In the latter part of the year both acetate of lime and acetic acid recovered from the low price levels which had been ruling and closing prices for the acid were the highest for the year. There was a steady movement of acid during the period with large amounts passing to the textile trade, corroders of lead, and to makers of acetates. Contract prices were reported to have been negotiated at private terms with the largest consumers receiving concessions from the open market quotations.

Production of acetic acid in 1923 was 84,888,000 lb. of less than 65 per cent and 25,972,000 lb. of glacial and anhydride. No production figures have been issued for later years but it is estimated that the output has risen in proportion to the expansion in consuming trades. Various reports were heard during the year relative to production of synthetic acetic acid but the latter did not appear to be any more of a factor than usual in domestic markets. Quantities were imported from Canada especially of the higher grades as the latter are more profitable to import on account of the tariff regulations. The latest import figures are for 1924, in which year arrivals of the higher grades amounted to 1,202,525 lb. with only 27,080 lb. of the lower grades coming in.

Large Export Movement for Silicate of Soda

One of the features to trading in silicate of soda last year was the gain in export shipments. For the 11 months ended November, exportations amounted to 36,521,810 lb. which compares with 30,492,563 lb. for the corresponding period of 1924. This represents a gain of about 20 per cent for the period. In the domestic trade a larger use of silicate was reported in the soap trade with other consuming industries taking regular allotments.

In the preliminary reports issued by the Bureau of the Census the production of silicate of soda for 1923 was given at a high figure which later was reported to be in error and revised figures gave the output at 419,158 tons of which 331,309 tons was offered for sale. The soap trade, in that year, was reported to have made and consumed 62,151 tons.

Prices for silicate of soda did not show any fluctuations during the past year as far as open quotations were concerned, but large stocks were in sellers' hands at times and sales prices were largely a matter of private terms, depending on the degree of competition and the amounts involved.

Sales Agreement for Foreign Tartaric Acid

There has been a steadily increasing growth in the amount of foreign tartaric acid in this country. The increase in imports is said to be larger than the gain in consuming requirements and evidently domestic production has been on a downward scale. Consumption of tartaric acid in this country is reported to be but little, if any, over 6,000,000 lb. per year. For the 11 months ended November, imports were 3,563,677 lb. as against 2,717,880 lb. for the corresponding period of 1924. This would indicate a domestic production of less than 3,000,000 lb. even after making allowance for surplus stocks. The fact that imported tartaric acid is supplying more than one-half of our needs makes of greater importance the announcement made in the latter part of the year, that three of the largest manufacturers of this acid in Germany had entered into an agreement by which sales were to be controlled. This was followed by an advance in quotations for foreword deliveries of the acid with the elimination of open quotations in German markets, the situation favors a slightly higher market for the coming year although the price is not expected to go high enough to stimulate any great increase in domestic production.

Nitrate of Soda in Larger Supply Last Year

The improvement in the fertilizer trade was reflected in a larger call for nitrate of soda last year and importations from Chile were larger than in 1924. It was stated that the fertilizer trade took the greater part of the increased supply and thus consumed a larger percentage of the total than in the preceding year. Total imports for the 11 months, ended November, were 1,069,208 tons as compared with 927,308 tons for the corresponding period in the preceding year.

Quotations for spot nitrate varied during the year according to the supplies on hand but main interest centered in the shipment quotations for delivery over the nitrate years. As was customary these prices were given in English currency and while they were unchanged from those which had prevailed for the preceding season, they represented an increase to importers because of the higher rate of exchange.

Large Early Production of Tetra-Ethyl-Lead

Up to 1923 there was no sustained production of tetra-ethyl lead in this country. In 1923 production was reported for the first time and from July 1924 to May 1925, production was reported to be 1,750,000 lb. In May manufacture of this chemical was practically discontinued. The prominence which it attained for a short time was due to its use in making anti-knock gasoline. The latter met with opposition because of its lead content and its manufacture and public sale were discontinued pending an investigation into the toxic effects of the product. No definite conclusion had been reached at the end of the year and the future prominence of tetra-ethyl lead will depend largely on whether or not it may be used for this purpose.

Smaller Output of Magnesite in 1924

According to a recent report of the Bureau of Mines, in 1924 mines in the United States sold or treated the equivalent of 120,000 short tons of crude magnesite, valued at $1,041,300, a decrease of 18 per cent in quantity but of only 6 per cent in value as compared with 1923. This estimated value of the total crude magnesite sold or treated is determined by arbitrary valuations f.o.b. shipping points by the operators and the operators in Washington place a very low value on crude magnesite. Of the total for 1924, 67,240 tons was from California and 52,860 tons from Washington. Most of the production in California was sold as caustic calcined magnesite, and most of that in Washington was sold dead-burned.

Production of Crude Magnesite

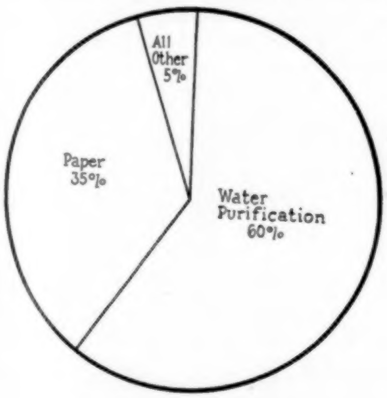
Year	Short Tons	Value
1910	156,226	$1,248,415
1920	303,767	2,748,150
1921	47,904	510,177
1922	55,790	571,745
1923	147,250	1,103,700
1924	120,100	1,041,300

Of the domestic magnesite produced in 1924 only 1,570 tons was sold crude, for use largely in making chemicals; 26,520 tons (46 per cent) was sold as caustic calcined magnesite, for use as plastic material; and 29,830 tons (51 per cent) was sold dead-burned, for use as a refractory. These figures show that the material actually sold in 1924 amounted to 57,920 tons, which computed as crude magnesite was equivalent to 120,100 tons.

At the end of the year producers reported that 6,000 tons of crude magnesite was in stock on dumps, exclusive of large quantities of fines held at several dumps to be calcined eventually.

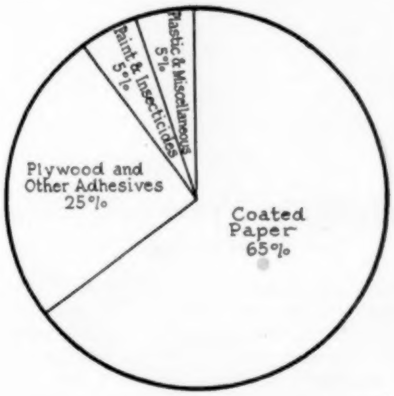
Turpentine Production for the Year Declined

While no authoritative figures are at hand upon which to determine total production of spirits of turpentine, trade opinions place the total as lower than that for the preceding season. Trade statistics gave 1923-1924 production as 26,072,200 gal. Allowing for a 15 per cent decrease for the current season, the total would be approximately 22,160,000 gal. Production for

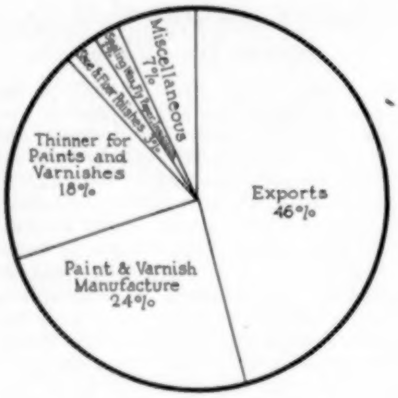


Sulphate of Alumina

Calcium Chloride Distribution



Outlets for Casein



Distribution of Turpentine

the past 5 crop years then would compare as follows:

	Gal.
1925-1926	22,160,000
1924-1925	26,072,200
1923-1924	27,174,580
1922-1923	22,394,137
1921-1922	24,378,854

By far the greater part of domestic consumption of spirits of turpentine is found in the paint and varnish trades. The growing use of pyroxlyn varnishes and lacquers and the use of turpentine substitutes has prevented the consumption of turpentine from keeping pace with the expansion in the paint and varnish industries. Labor conditions in the turpentine producing sections, especially in Florida, have militated against an increase in production and the existence of these conditions make it difficult to form a definite opinion regarding the output for the coming season.

Export trade during the past year was on a steady basis with larger amounts shipped to outside countries than were reported for 1924. Official figures for December exports have not yet been published but the figures of monthly shipments in the past 2 years show as follows:

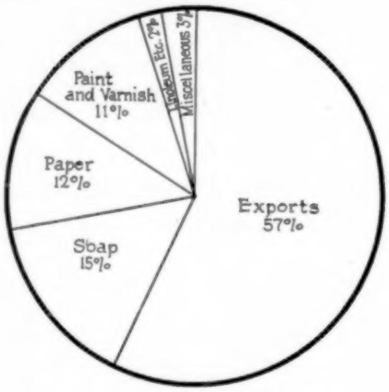
	1925 Gal.	1924 Gal.
January	652,128	574,412
February	882,542	329,933
March	521,947	429,822
April	485,271	360,228
May	1,084,658	1,196,051
June	1,397,603	1,338,369
July	1,329,670	2,153,788
August	1,862,934	1,261,118
September	1,008,625	973,459
October	1,173,293	1,496,158
November	615,754	450,496
December	....	946,320
Totals	11,017,211	11,510,154

Prices for spirits of turpentine have been higher than the pre-war levels and have been affected to a greater less extent by higher prdoucing costs. The range in the New York market last year was from 84c. per gal. to $1.19 per gal., the prices referring to carload lots.

High Prices Featured Trade in Rosins

Price developments stood out as the feature in the market for rosins last year. With the exception of the peak prices reached in war years, sales were put through at record values for the industry. The upward swing to values followed a continuance of active consuming demand which was in excess of production. Conditions in producing centers are not favorable for enlarging outputs and the reduction in productive possibilities has created fears for future supplies. The statistical situation, therefore, has exerted a bullish influence on market values. This is true not only because of the preponderance of consumption over production but also because this discrepancy in recent years has made it necessary to dip freely into surplus stocks and the latter have been reduced to a point where they no longer are a factor in determining values. The fact that no future replenishment of stocks is probable makes it certain that the average level of prices which prevailed for the past 5 years has given way to new price standards which will continue until a closer mean arises between demand and supply. This can be brought about only by a reduction in the buying movement or by a material increase in the output.

The crop year for rosins begins with April 1 and for the 1925-26 season it is estimated that production will be more than 10 per cent less than that for the 1924-1925 season. This would mean a crop of approximately 1,500,000 bbl. of 500 lb., as the total for 1924-1925



Rosin Consumption By Industries

was placed at 1,821,000 bbl. Production for the past 5 years, in terms of 500-lb. bbl. was as follows:

	Bbl.
1925-1926	1,500,000
1924-1925	1,721,000
1923-1924	1,790,087
1922-1923	1,499,538
1921-1922	1,661,624

A decade ago average annual production of rosins was in excess of 2,000,000 bbl. so that the decline in the industry is apparent by comparison with the production in more recent years. For many years the export trade has offered the widest outlet for this material. In the 1924-1925 season, total consumption of rosin was given as amounting to 2,200,000 bbl., divided 800,000 bbl. for home consumption and 1,400,000 bbl. for export. It will be noted that the consumption figures exceed those for production which is explained by the decline in surplus stocks. Hence exports accounted for more than 60 per cent of all the rosin moved. While exports for the 1925-1926 season will not come up to the total for the preceding season, the percentage will approximate 57 per cent of the whole movement.

Exports of rosin for the past 2 calendar years are shown as follows, the figure for December, 1925, being missing:

	1925 Bbl.	1925 Bbl.
January	96,336	110,604
February	116,250	97,494
March	82,799	79,508
April	76,244	101,890
May	127,606	100,345
June	89,728	140,463
July	130,435	143,769
August	123,540	155,144
September	119,144	141,390
October	92,898	148,419
November	62,381	104,695
December	......	128,666
Totals	1,118,604	1,452,387

Price fluctuations for rosin were numerous and the high levels attained made the year memorable in the trade. Opening prices for W. W. grade were $10.25 per bbl. This quotation was advanced early in the year and with few recessions, the trend of values was steadily upward until the high point of $16.65 per lb. indicated the views of sellers. At the close of the year $16.50 per bbl. was the prevailing quotation which showed that there had been very little decline from the topmost price.

Big Gain in Consumption of Cottonseed Oil

The 1924-1925 season for cottonseed oil opened with a large production in prospect. The seed supply was estimated to be large enough to make a supply of refined oil well in excess of 3,000,000 bbl. Bearish sentiment, however, soon gave way to a feeling that values were destined to advance because other commodity markets were steadily advancing. The lard market in particular was in a strong position as a result of a decreased supply of hogs and a runaway market for corn. The rapid rise in lard values had a stimulating effect on oil values but the latter moved more slowly and the differential between lard and oil values widened to hitherto unheard of proportions. Naturally this condition expanded the call for lard compound and thus created an unusually large outlet for oil. Total consumption of refined oil in the 1923-1924 season was placed at 2,236,000 bbl. and for the 1924-1925 season at 3,078,000 bbl. or an increase in the latter year of more than 37 per cent.

According to the monthly statistics issued by the Bureau of the Census, the disappearance of refined oil into consuming trades shows the following comparisons:

	1924-1925 Bbl.	1923-1924 Bbl.
August	216,000	203,000
September	157,000	169,000
October	328,000	232,000
November	281,000	219,000
December	238,000	145,000
January	262,000	203,000
February	228,000	153,000
March	293,000	162,000
April	193,000	188,000
May	278,000	179,000
June	302,000	153,000
July	302,000	230,000
Totals	3,078,000	2,236,000

Stocks of refined oil, including crude oil and seed in refined equivalent, on Aug. 31, 1925 were 472,000 bbl. as com-

pared with 291,000 bbl. on Aug. 31, 1924. Hence the apparent production of oil in terms of refined amounted to 3,259,000 bbl. From the present cotton crop it is estimated that production of refined oil for the 1925-1926 season will be 3,416,946 bbl. With the carryover this would give a total supply of 3,888,-946 bbl. or an average monthly supply of about 324,000 bbl. Average monthly consumption last season was 256,500 bbl. This apparently would indicate a year of low prices but shipments of oil for the first 4 months of the 1925-1926 season amounted to approximately 1,345,000 bbl. which compares with 982,000 bbl. for the corresponding period last season. The increase in consumption therefore has been greater than that for production and this renders it difficult to form a definite opinion on future values as so many factors outside the immediate oil market have a bearing on price levels.

Imports of China Wood Oil Establish Record

A new high record for imports was registered in the China wood oil trade during the past year. Total arrivals for the 11 months ended November were 92,947,034 lb. as compared with 68,510,785 lb. for the corresponding period of 1924. This makes an increase of about 35 per cent for the year. The increase in importations, however, does not justify the belief that consuming requirements were enlarged accordingly. In some quarters, complaints were heard about slow call for wood oil and the rapid rise of pyroxylin varnishes was reported to have made inroads on wood oil consumption. There was a large demand for wood oil, however, but it is equally certain that unsold stocks in this country were increased. Political conditions in China had a disturbing effect on the movement of oil from the interior to terminal points and this undoubtedly had some influence in prompting importers to take on stocks when they were sure that deliveries would be made. It was a case of transferring stocks from primary points to consuming markets and the fact that primary markets held up in price, prevented any real selling pressure in domestic markets.

Imports of wood oil for the past two years were as follows, the figures for December, 1925, not yet being available:

IMPORTS OF CHINA WOOD OIL

	1925 Lb.	1924 Lb.
January	9,079,825	6,931,462
February	9,329,769	5,835,443
March	12,067,968	6,749,021
April	6,225,939	6,922,202
May	6,778,891	4,690,234
June	7,237,629	6,484,546
July	11,619,278	3,949,830
August	6,033,330	3,184,197
September	2,468,172	6,997,672
October	13,798,362	7,865,636
November	8,307,871	8,900,542
December	....	13,077,069
Totals	92,947,034	81,587,854

Asking prices for wood oil in bbl. at New York opened at 15½c. per lb. with firm markets ruling abroad. The low point of 12c. per lb. was reached in the summer when the market was upset for a short time by heavy arrivals. Values then turned upward but eased off toward the end of the year with 13c. per lb. as the closing quotation.

High and low prices for China wood oil at New York for the past 6 years were as follows:

	High	Low		High	Low
1925	$0.15½	$0.12	1922	$0.14¾	$0.11½
1924	.21	.12½	1921	.17	.08½
1923	.40	.14¾	1920	.30	.13

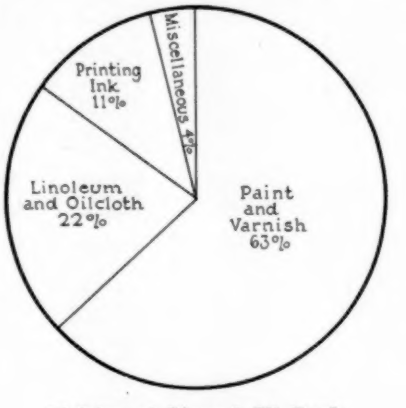
Linseed Oil Quotations on Pound Basis

An innovation in the linseed oil trade was found during the latter part of the year when crushers put into practice a method of quoting this oil on a pound basis thus supplanting the gallon quotations which had prevailed up to that time. Actually oil had been sold by weight for many years with the gallon specified as equal to 7½ lb. The change brings the quotations in line with the actual method of doing business and also is in accord with the custom surrounding the sale of most other vegetable oils.

Assuming an even balance between carry over of oil at the beginning and end of the crop year, production of oil for 1924-1925 season was approximately 100,000,000 gal. This is the equivalent of a seed supply as follows:

	Bushels
Domestic receipts	31,344,402
Imports of seed	12,120,050
Imports of oil (seed equivalent)	620,745
Total	44,085,197

Official figures give linseed oil production for the first 9 months of the year as 705,585,985 lb. which was about on a par with that for the



Division of Linseed Oil Trade

corresponding period last year. There was very little change in the distribution of oil by industries, the paint and varnish continuing to hold the premier position with linoleum and oilcloth, and the printing ink trades following in the order named.

The high prices which were reached by wheat and other grains was not conducive to a larger linseed acreage and late in the spring it became evident that a smaller area would be seeded to linseed. This was verified when the government issued preliminary reports and prospects were further discouraged by reports of unfavorable growing conditions. In December the final estimate was issued and revealed a decline in outturn of about 27 per cent under that for the preceding season.

The final report on acreage and yield shows the following comparisons with those for the past 5 years:

	Acres	Bushels
1925	3,012,000	22,007,000
1924	3,289,000	30,173,000
1923	2,014,000	17,060,000
1922	1,113,000	10,375,000
1921	1,108,000	8,029,000
1920	1,757,000	10,774,000

High and low prices for linseed oil in the New York market for the past 2 years were as follows, the prices being in cents per lb. for carload lots:

	1925		1924	
	High	Low	High	Low
January	16	15	12	12
February	16	15	12.1	12
March	15.9	14.4	12.4	12.1
April	14.4	13.8	12	12
May	14.1	13.8	12	11.9
June	14.8	13.6	12.5	12
July	14.1	13	12.5	12.4
August	14	13	12.8	12.5
September	13.6	13.3	13.3	13
October	13.6	13.3	13.6	13.5
November	13.6	12.8	13.3	13
December	12.8	11.9	15.3	14

Importations of flaxseed for the 11 months ended November, 1925, and for the 12 months of 1924 were as follows:

	1925, Bushels	1924, Bushels
January	678,445	427,743
February	1,798,261	1,128,662
March	833,927	2,284,763
April	2,121,883	1,959,824
May	2,152,700	3,678,647
June	1,328,468	2,494,839
July	935,641	2,207,888
August	1,081,958	1,217,748
September	729,076	460,449
October	1,278,248	205,907
November	1,759,379	26,719
December	....	495,692
Totals	14,588,986	16,588,881

Reports of a record breaking crop were coming from the Argentine and it is generally conceded that the exportable surplus in that country will be larger than ever before. Estimates on the extent of the crop vary but the exportable is expected to be around 60,000,000 bu. Shipments from the Argentine in the past 2 years were as follows:

Shipped to	1925, Bushels	1924, Bushels
United Kingdom	2,340,000	7,624,000
Continent	19,284,000	26,222,000
United States	12,552,000	14,503,000
Orders	7,272,000	10,330,000
Totals	41,448,000	58,679,000

Bulk Shipments of Palm Oil From Sumatra

During 1925 was made the first shipment of palm oil in bulk from Sumatra to the United States. The initial shipment approximated 700 tons. Great progress is reported in the production of palm oil in Sumatra and trade with the United States has increased rapidly. From Jan. 1 to the middle of September shipments amounted to 1,167,188 lb., while for the entire year, 1924, only 339,845 lb. were sent to the United States.

Exports of Chemicals and Allied Products

		12 Months Ended December				11 Months Ended November	
		1923		1924		1925	
		Quantity	Value	Quantity	Value	Quantity	Value
Animal oils							
Oleo oil	Lb.	98,954,914	$11,841,001	99,379,879	$14,113,338	83,649,196	$10,794,849
Neatsfoot oil	Lb.	1,144,812	198,171	1,824,023	276,981	1,252,348	222,955
Other animal oils	Lb.	1,514,821	165,467	1,306,564	161,973	1,919,339	249,528
Fish oils	Lb.	1,000,409	137,107	778,273	119,294	574,103	105,381
Oleo stock	Lb.	10,300,600	1,172,756	13,797,405	1,711,311	11,625,835	1,450,434
Tallow	Lb.	35,876,238	2,972,690	33,961,646	2,899,302	16,456,555	1,535,632
Lard	Lb.	1,035,381,571	130,171,943	944,095,014	126,728,262	619,988,692	107,175,081
Lard compounds	Lb.	7,450,591	1,014,653	7,381,985	1,023,303	12,385,658	1,804,703
Stearins and fatty acids							
Oleo and lard stearin	Lb.	8,765,194	941,989	6,575,373	752,705	6,809,872	879,685
Grease stearic	Lb.	3,520,096	333,196	3,007,865	303,112	2,551,800	285,660
Oleic acid, or red oil	Lb.	1,728,091	143,954	2,689,146	226,123	458,544	48,426
Stearic acid	Lb.	2,709,120	352,915	1,908,560	230,923	1,766,931	257,441
Oleo margarine, animal	Lb.	1,792,436	293,357	774,302	126,244	578,900	100,609
Other greases, oils and fats	Lb.	60,675,870	5,380,813	79,394,223	7,329,411	76,179,568	8,843,848
Glue, animal origin	Lb.	2,510,108	386,029	2,172,701	348,285	2,337,538	350,071
Wax manufactures	Lb.	1,748,551	334,218	1,586,435	331,308	1,186,372	265,185
Oil cake and meal	Lb.	917,454,494	19,838,284	1,289,947,813	27,589,790	1,304,444,993	27,837,266
Cottonseed cake	Lb.	292,263,128	6,773,018	410,991,534	8,673,425	474,435,997	9,879,248
Linseed cake	Lb.	532,617,638	11,058,112	632,560,692	13,654,881	577,833,042	12,820,665
Other oil cake	Lb.	2,471,604	49,825	3,375,377	67,572	16,643,103	253,997
Cottonseed meal	Lb.	52,162,800	1,136,747	210,773,675	4,496,614	203,437,020	4,244,962
Linseed meal	Lb.	32,081,988	699,777	20,993,940	445,631	11,936,474	278,689
Other oil-meal	Lb.	3,591,650	73,223	11,252,595	251,667	20,159,357	359,705
Oilseeds	Lb.	2,583,798	137,232	3,267,596	221,686	3,457,227	259,871
Vegetable oils expressed, and fats							
Linseed oil	Lb.	3,013,216	407,863	2,386,685	317,995	2,242,016	318,121
Soy-bean oil	Lb.	1,356,220	139,557	2,264,195	252,571	518,168	43,319
Corn oil	Lb.	4,361,100	558,834	3,678,608	495,777	3,609,976	484,079
Cocoa butter	Lb.	762,371	215,247	845,769	217,736	2,297,136	650,897
Vegetable oleomargarine	Lb.	1,745,414	240,778	127,133	20,811	142,623	23,086
Vegetable oil lard compounds	Lb.	9,616,686	1,338,834	6,988,528	976,399	7,421,533	1,113,126
Vegetable soap stock	Lb.	3,814,986	257,393	5,528,330	299,590	6,763,956	435,303
Other vegetable oils and fats	Lb.	8,508,711	976,133	5,429,393	698,852	7,806,339	846,399
Naval stores							
Rosin	Bbl.	1,205,649	11,057,980	1,452,387	13,754,790	1,118,604	17,668,409
Spirits of turpentine	Gal.	11,478,459	12,303,809	11,510,154	10,105,015	11,017,211	10,784,566
Wood turpentine	Gal.	393,811	405,870	561,446	443,340	535,993	405,257
Turpentine substitutes	Gal.	844,952	358,103	987,825	344,824	960,059	280,470
Tar and pitch wood	Bbl.	74,692	375,761	51,241	266,786	23,142	184,602
Other gums and resins	Lb.	2,079,080	676,232	2,139,541	739,203	2,394,497	844,969
Dye extracts							
Longwood extract	Lb.	1,954,098	264,207	1,483,954	189,052	2,051,845	231,352
Other dye extracts	Lb.	2,298,788	322,663	1,689,655	221,895	1,321,689	143,046
Dyeing and tanning materials, crude	Ton	1,442	90,579	2,206	9,921	7,818	136,417
Tanning extracts							
Chestnut	Lb.	8,714,834	307,579	9,275,657	290,728	6,474,831	195,287
Other tanning extracts (vegetable and chemical)	Lb.	23,466,809	1,172,094	22,546,421	1,137,888	18,333,098	1,077,967
Starch							
Cornstarch	Lb.	195,020,108	5,895,139	265,151,419	8,522,143	206,263,889	7,454,232
Other starch	Lb.	9,215,033	320,452	5,231,607	221,017	8,342,020	315,616
Vegetable glue	Lb.	774,877	85,451	1,081,758	86,338	799,909	75,429
Mineral oils							
Petroleum, crude	Gal.	716,551,862	23,111,816	742,134,849	26,586,011	514,415,257	22,601,120
Petroleum, ref.	Gal.	3,270,638,102	326,599,065	3,919,538,229	391,896,425	3,550,642,067	381,841,443
Gas and fuel oil	Gal.	1,228,594,295	35,708,049	1,437,551,923	49,261,598	1,226,602,171	44,815,687
Paraffin wax							
Unrefined	Lb.	94,316,692	2,769,448	92,632,299	4,109,237	63,813,944	3,397,525
Refined	Lb.	235,475,857	8,657,857	290,187,716	14,415,903	238,009,722	13,463,970
Lime	Bbl.	117,887	170,289	149,053	212,340	136,883	202,338
Sulphur	Ton	472,525	7,105,260	481,814	7,786,254	571,225	9,941,384
Salt	Lb.	251,057,170	1,211,226	289,889,103	1,288,376	273,186,776	1,087,308
Zinc dust	Lb.	7,357,049	507,289	4,539,464	353,867	4,082,366	367,594
Coal-tar products	......	....	12,331,666	....	9,976,052	....	9,621,475
Crudes							
Benzol	Lb.	111,336,768	3,647,660	57,882,171	1,739,837	52,883,832	1,522,378
Crude tar and pitch	Bbl.	513,834	1,694,494	269,015	1,076,203	88,283	243,776
Other crudes	Lb.	9,060,704	300,257	14,505,160	454,386	19,279,989	593,029
Intermediates							
Aniline oil and salts	Lb.	497,457	95,013	375,459	101,437	728,003	142,011
Other intermediates	Lb.	1,218,183	243,060	1,557,429	240,413	1,557,631	285,582
Finished products							
Coal-tar colors, dyes, and stains	Lb.	17,924,536	5,565,371	15,713,091	5,635,064	22,795,336	6,013,671
Medicinals	Lb.	237,975	164,160	288,405	321,766	525,696	379,765
Photographic chemicals	Lb.	214,160	96,317	173,995	80,751	277,232	86,614
Other coal-tar finished products, n. e. s	Lb.	4,527,146	480,549	2,147,368	304,962	2,828,487	284,452
Medicinal and pharmaceutical preparations							
Quinine, sulphate and other salts of cinchona	Oz.	392,328	166,736	321,490	168,103	658,808	220,803
Antitoxins, serums, and vaccines	C.C.	11,151,218	418,711	31,503,763	1,054,870	28,330,811	1,115,114
Other medicinal and pharmaceutical preparations	Lb.	34,583,318	15,591,301	31,322,211	15,600,864	31,925,065	15,920,619
Crude drugs, essential oils, dyeing, and tanning materials (total)	......	....	6,712,371	....	7,647,613	....	5,760,591
Drugs, herbs, leaxes, and roots, crude							
Ginseng	Lb.	148,385	2,245,258	167,318	2,399,926	95,535	1,239,102
Other crude vegetable drugs	Lb.	5,961,533	1,297,964	7,722,346	1,640,183	5,245,157	1,203,285
Essential oils							
Peppermint	Lb.	123,212	366,273	176,820	846,528	64,898	720,482
Other	Lb.	637,705	645,754	1,097,725	828,402	1,218,853	813,653
Glass, window, common	Box	50,682	256,243	41,536	186,986	23,900	135,502
Glass, plate	Sq.Ft.	1,981,767	843,792	1,809,300	516,163	1,383,971	367,340
Glass, window, etc	Lb.	3,397,376	375,412	2,105,976	221,268	2,261,766	254,941
Chmical glassware	Lb.	247,443	175,801	238,195	190,666	207,676	176,339
Ferro-alloying ores and metals							
Ferromanganese and spiegeleisen	Ton	4,295	151,224	3,165	92,421	5,456	153,835
Ferrotungsten, tungsten metal, and wire	Lb.	5,376	122,906	4,578	114,775	10,482	122,592
Ferrovanadium	Lb.	51,416	64,713	54,943	81,016	81,703	84,519
Other ferro-alloying ores and metals	Lb.	239,511	27,501	805,230	94,825	3,287,576	232,584
Printers ink	Lb.	10,100,105	1,273,813	10,415,983	1,279,209	10,188,287	1,163,210
Paste and mucilage	Lb.	2,403,994	261,221	2,506,602	283,322	3,276,270	375,428
Candles	Lb.	1,894,735	276,634	1,287,067	224,202	1,243,333	224,018
Rubber	......	....	36,972,125	....	39,650,217	....	46,320,832
Pulp wood	Cu.Ft.	1,073,269	71,594	2,204,923	157,448	957,111	60,367
Coke	Ton	1,104,770	11,889,897	588,705	4,926,478	720,267	5,681,929
Magnesia and manufactures of	Lb.	5,391,219	337,044	3,120,070	243,579	4,738,604	284,410

Exports of Chemicals and Allied Products—Continued

		12 Months Ended December				11 Months Ended November	
		1923		1924		1925	
		Quantity	Value	Quantity	Value	Quantity	Value
Acids and anhydrides							
Acetic	Lb.	763,850	$94,025	707,078	$78,797	615,830	$67,710
Sulphuric	Lb.	8,243,767	169,161	11,272,673	180,012	6,955,692	138 095
Boric	Lb.	891,670	104,912	727,082	79,081	724,715	73,674
All other	Lb.	10,671,802	667,835	10,767,011	621,472	12,270,150	596,584
Alcohols							
Methanol, pure and denaturing	Gal.	1,207,023	1,275,284	640,637	686,911	335,093	279,223
Other alcohol	pf. Gal.	404,837	170,155	312,187	213,298	397,524	337,262
Ammonia and ammonium compounds	Lb.	11,343,804	1,202,976	3,496,363	916,403	4,056,172	834,369
Aluminum sulphate	Lb.	35,490,560	504,292	32,024,332	407,768	37,379,260	454,927
Baking powder	Lb.	4,155,725	1,762,476	3,952,340	1,534,886	3,668,324	1,387,885
Calcium compounds							
Acetate of lime	Lb.	21,951,287	806,857	23,166,759	733,137	19,068,562	594,830
Calcium carbide	Lb.	8,244,408	384,166	9,667,546	428,492	4,681,272	198,984
Bleaching powder	Lb.	28,828,428	525,436	21,602,125	380,156	25,695,063	437,391
Copper sulphate	Lb.	2,290,206	130,879	2,988,039	142,626	4,533,562	209,259
Dextrine or British gum	Lb.	16,206,340	626,486	22,190,677	899,991	20,807,144	949,869
Formaldehyde	Lb.	3,336,983	429,546	2,897,822	322,214	2,305,989	241,517
Glycerin	Lb.	1,767,407	318,765	1,415,882	237,639	1,150,678	238,746
Petroleum jelly	Lb.	8,774,513	1,164,538	10,020,740	1,228,923	5,858,047	963,194
Potash							
Bichromate of	Lb.	3,262,760	295,751	1,169,266	100,017	420,603	32,364
Other	Lb.	4,532,495	188,091	2,113,189	169,442	3,694,364	340,354
Sodas and sodium compounds							
Cyanide	Lb.	5,005,952	473,675	4,210,172	489,524	1,390,429	243,290
Borax	Lb.	40,498,964	1,606,054	33,741,676	1,601,375	30,941,558	1,380,058
Soda Ash	Lb.	29,023,704	729,870	28,683,296	683,118	29,444,598	711,803
Silicate	Lb.	33,103,433	316,543	32,705,217	301,571	36,521,810	320,293
Sal soda	Lb.	12,224,131	179,006	13,078,544	199,133	12,553,283	184,944
Caustic	Lb.	114,683,728	3,827,403	92,115,631	2,862,809	88,956,318	2,685,153
Bicarbonate	Lb.	16,934,348	387,861	15,223,786	333,337	16,314,182	329,290
Other sodium compounds	Lb.	148,763,626	2,407,509	95,772,336	2,033,563	97,097,807	1,317,220
Washing powder and fluid	Lb.	5,732,091	307,900	4,420,398	260,350	3,978,767	245,655
Other chemicals, medicinal and pharmaceutical	Lb.	79,438,052	7,120,204	75,550,464	7,292,897	75,515,560	8,116,364
Pigments, paints and varnishes	...	....	16,551,716	....	14,326,200	....	16,660,714
Mineral with pigments, ocher, umber, sienna, metallic, whiting, etc	Lb.	28,584,484	999,177	28,206,731	823,563	27,931,301	826,705
Chemical pigments							
Zinc oxide	Lb.	10,047,408	743,577	7,854,394	605,630	19,557,699	1,361,333
Lithopone	Lb.	2,970,743	176,624	1,845,073	104,783	2,361,490	131,451
Bone black	Lb.	3,018,530	181,383	1,971,857	123,201	....	....
Carbon and lamp black	Lb.	29,020,743	4,723,166	34,428,855	3,385,852	37,495,442	3,077,052
Red lead	Lb.	3,680,663	372,828	1,880,263	210,598	1,528,447	174,325
White lead	Lb.	10,344,089	836,275	10,109,455	853,444	12,717,631	1,196,582
Other chemical pigments	Lb.	6,561,780	633,239	5,156,313	614,385	6,100,857	702,246
Paints, stains and enamels							
Enamel paints	Lb.	2,128,074	582,019	1,874,598	483,079	2,385,408	774,709
Other ready-mixed paints	Gal.	1,838,330	3,736,725	2,015,849	4,029,931	2,038,690	4,256,411
Other paints	Lb.	11.502,947	1,934,444	8,383,119	1,485,066	10,352,751	2,122,316
Varnishes							
Oil varnishes	Gal.	558,097	1,005,441	652,312	1,122,982	638,915	1,152,113
Other varnishes	Gal.	408,005	626,818	283,835	483,686	356,758	675,942
Fertilizers and fertilizer materials	Ton	1,096,612	20,557,992	1,068,255	16,506,874	1,021,963	15,584,935
Sulphate of ammonia	Ton	150,544	10,874,627	118,367	6,918,598	110,728	6,075,832
Phosphate materials							
Phosphate rock—							
High-grade hard rock	Ton	194,339	2,477,501	150,746	1,814,194	149,310	2,137,951
Land pebble	Ton	630,565	3,273,006	656,005	3,209,965	609,836	2,882,416
Other phosphate rock	Ton	2,641	21,664	12,022	96,673	12,258	97,701
Superphosphates (acid phosphate)	Ton	42,156	541,460	45,751	588,620	62,771	946,274
Prepared fertilizer mixtures	Ton	17,997	832,948	35,793	1,695,472	28,275	1,457,693
Other fertilizers	Ton	45,073	1,921,972	44,872	1,900,198	42,847	1,651,781
Explosives	Lb.	21,407,708	3,535,705	19,023,118	2,889,699	20,362,813	3,420,373
Smokeless powder	Lb.	1,699,406	567,519	291,929	135,588	1,104,180	606,865
Other gunpowder	Lb.	402,401	186,705	576,292	167,854	409,210	135,430
Blasting powder	Lb.	1,449,634	120,111	2,485,143	181,822	1,980,994	148,443
Dynamite	Lb.	16,982,676	2,482,562	14,749,991	2,201,476	15,115,588	2,172,402
Other explosives	Lb.	873,591	178,808	919,763	202,959	1,752,841	357,233
Soap							
Toilet or fancy	Lb.	7,369,539	3,002,480	5,376,453	2,400,616	6,018,493	2,518,478
Laundry	Lb.	66,498,491	4,701,141	54,276,016	3,814,139	51,204,777	3,691,515
Other soap	Lb.	18,456,371	1,583,011	17,724,053	1,517,948	11,506,152	1,087,412
Perfumery and toiler waters	Lb.	655,750	562,385	400,435	409,638	411,156	409,609
Talcum and other toilet powders	Lb.	3,814,379	1,671,588	3,288,923	1,688,238	3,155,090	1,696,522
Creams, rouges, and other cosmetics	Lb.	2,148,663	1,093,747	2,267,469	1,186,569	2,264,819	1,183,408
Dentifrices	Lb.	2,983,088	2,439,427	3,078,307	2,793,262	3,105,315	2,932,171
Other toilet preparations	Lb.	1,849,415	1,111,536	1,586,091	1,174,343	1,543,479	1,075,657
Pyroxylin products, known as celluloid, pyralin, viscoloid, fiberloid, etc.							
In blocks, sheets, or rods	Lb.	1,940,071	2,346,798	2,003,983	2,017,417	2,302,265	1,956,155
Manufactures of	Lb.	637,856	921,897	788,802	1,043,318	1,666,719	1,646,537
Blackings and polishes							
Shoe polishes	Lb.	5,435,300	1,213,631	5,639,884	1,331,685	4,896,787	1,181,014
Other blackings and polishes	Lb.	2,620,038	446,095	2,407,087	454,194	2,370,574	477,473
Clays							
Fire clay	...	44,692	303,675	37,236	312,676	36,150	318,730
Other clays	...	31,107	329,192	27,724	420,040	32,410	485,803
Graphite							
Unmanufactured	Lb.	1,815,292	138,542	2,043,411	144,108	1,723,888	130,926
Manufactures of	Lb.	2,081,041	335,778	1,529,035	250,957	2,202,911	316,743
Metal polishes	Lb.	2,264,728	281,674	3,397,924	401,042	2,605,795	316,029
Asbestos							
Unmanufactured	Ton	607	48,525	1,134	93,163	989	70,746
Paper, millboard and rollboard	Lb.	3,559,848	190,755	2,171,674	124,228	2,004,757	107,109
Pipe covering and cement	Lb.	5,667,731	426,085	4,848,030	288,266	4,141,363	251,309
Textiles, yarn and packing	Lb.	1,037,786	672,488	1,197,508	788,361	1,287,544	752,982
Other manufactures of asbestos, except roofing	Lb.	3,249,762	800,623	2,728,741	2,978,857	2,048,372	317,314
Carbons, carbon brushes and electrodes	Lb.	30,222,887	2,317,495	31,497,325	2,978,857	....	....
Chalk, manufactures of	Lb.	1,225,340	150,679	1,028,439	120,621	1,500,110	215,241
Gypsum or plaster, crude, ground, calcined, and manufactures of	Lb.	17,629,808	226,423	21,246,736	358,425	30,027,449	431,397
Fire clay bricks	M	44,896	1,744,778	24,056	708,381	21,310	599,255
Other refractory bricks	M	5,152	447,380	12,732	1,126,678	12,979	1,185,311
Refractory shapes	Lb.	27,350,054	612,324	31,530,589	753,762	24,292,402	621,860
Crucibles	No.	463,265	132,228	548,893	96,001	369,384	85,136
Nickel, monel metal and alloys	Lb.	868,158	307,269	1,938,042	565,911	2,321,852	758,202
Bauxite	Ton	78,560	3,380,486	77,065	3,979,832	72,398	3,884,240

Imports of Chemicals and Allied Products

		12 Months Ended December				11 Months Ended November	
		1923		1924		1925	
		Quantity	Value	Quantity	Value	Quantity	Value
Albumen, egg	Lb.	7,046,229	$2,711,676	3,763,936	$2,321,099	8,110,921	$3,648,892
Animal and fish oils, fats and greases							
Whale oil	Gal.	3,977,003	2,068,038	5,074,271	2,515,325	7,337,264	4,296,766
Cod and cod-liver oil	Gal.	2,396,565	1,334,684	2,846,588	1,572,398	2,657,311	1,717,073
Other fish oils	Gal.	716,750	225,997	751,374	253,823	751,748	396,045
Beef and hog fats	Lb.	11,373,792	879,167	3,417,936	314,616	2,460,840	258,645
Grease and oils, n e.s.	Lb.	10,426,801	552,010	...	236,237	...	197,892
Gelatin, edible	Lb.	3,125,406	911,270	3,140,391	612,088	2,760,544	563,846
other	Lb.	2,021,555	952,923	1,869,336	1,174,422	1,543,357	907,164
Glue and glue size	Lb.	7,228,255	648,261	7,645,276	617,115	4,602,831	425,435
Casein	Lb.	26,489,992	4,409,744	17,749,985	1,384,661	17,900,589	1,494,620
Beeswax and other animal wax	Lb.	3,182,714	687,742	3,096,413	717,581	3,202,318	1,039,039
Oil cake and meal							
Bean	Lb.	31,223,638	545,297	47,084,672	895,869	23,032,956	439,760
Coconut	Lb.	63,007,150	671,635	67,676,940	891,842	27,800,924	409,956
All other	Lb.	29,893,212	547,547	39,809,932	693,931	29,922,210	570,406
Vegetable tallow	Lb.	9,738,939	1,382,210	5,196,904	367,581	6,423,472	505,438
Vegetable wax	Lb.	17,769,735	1,906,168	7,864,644	1,293,458	5,688,277	1,129,689
Varnish, gums and resins							
Damar	Lb.	11,484,136	1,482,168	9,625,694	1,088,111	11,113,046	1,341,972
Kauri	Lb.	8,917,337	2,018,187	5,869,308	1,102,381	4,281,947	740 185
Shellac	Lb.	38,446,775	22,955,251	24,552,998	13,139,000	18,274,788	9,446,832
All other	Lb.	36,794,233	3,962,114	27,821,690	4,013,934	33,707,289	5,417,233
Tar, pitch, and turpentine	Lb.	...	69,926	...	152,323	...	257,669
Gum, Arabic	Lb.	9,857,703	1,239,788	7,306,795	762,462	6,701,057	722,780
Tragacanth	Lb.	1,203,218	590,438	831,225	300,739	877,931	374,697
Gambier	Lb.	6,321,653	442,816	4,691,340	483,454	3,592,653	497,494
All other	Lb.	8,756,136	959,419	7,596,350	750,356	14,723,054	1,204,065
Oil seeds							
Cotton seed	Lb.	68,841,666	946,208	95,052,650	1,399,485	51,577,396	649,921
Castor beans	Lb.	88,539,307	3,040,858	84,977,470	3,790,112	100,010,351	4,565,147
Copra	Lb.	332,974,498	13,477,469	285,426,953	12,600,833	324,099,270	16,010,351
Flaxseed	Bu.	24,332,329	48,956,956	16,588,881	30,037,639	14,588,986	35,441,443
Poppy seed	Lb.	6,548,607	658,411	5,464,208	458,027	3,388,703	335,980
Other oil seeds, free	Lb.	25,581,173	1,150,944	23,486,571	995,694	14,351,817	712,269
duty	Lb.	9,900,009	350,786	5,153,406	179,937	3,933,778	170,066
Vegetable oils and fats							
China wood oil	Gal.	11,638,890	13,397,000	81,587,854	11,091,776	92,947,034	10,471,428
Coconut oil, free	Lb.	178,788,397	12,710,739	222,665,376	17,128,480	203,804,608	16,990,153
duty	Lb.	3,093,752	235,459	128,065	13,153	249,767	27,540
Cocoa butter	Lb.	418,393	9,016	1,778,859	309,767	61,608	17,138
Olive oil, edible	Lb.	77,190,457	12,217,505	76,186,446	12,584,969	84,311,776	14,554,579
inedible	Gal.	5,413,938	3,393,701	7,239,630	807,243	10,560,215	1,192,808
Palm oil	Lb.	128,494,679	9,339,481	101,779,802	7,002,462	122,451,975	9,763,087
Peanut oil	Lb.	8,008,622	759,904	15,394,836	1,325,538	2,707,345	341,550
Linseed oil	Lb.	2,124,330	1,423,431	13,247,190	1,067,351	11,964,186	1,266,038
Soya bean oil	Lb.	41,679,110	2,680,200	9,125,158	623,798	17,584,900	1,328,817
Other vegetable oils, free	Lb.	8,547,617	588,773	10,984,930	1,244,259	9,992,872	1,274,435
duty	Lb.	2,201,474	169,464	6,426,678	481,842	598,575	66,660
Dyeing and tanning materials (vegetable)							
Logwood	Ton	36,431	659,995	14,928	252,725	21,166	369,700
Mangrove bark	Ton	5,886	160,078	2,164	45,317	1,747	78,391
Myrobalans	Ton	27,165	594,521	10,041	226,609	10,126	388,339
Quebrachowood	Ton	24,236	382,436	24,588	335,992	22,739	386,574
Sumac	Ton	6,963	414,737	4,694	474,461	2,520	310,280
Valonia	Lb.	16,450,341	334,446	16,681,371	244,396	19,084,047	329,923
Other crude	Lb.	75,829,206	1,383,069	50,993,992	900,730	47,927,736	1,082,596
Extracts for dyeing, etc	Lb.	4,714,969	343,512	3,035,977	292,947	3,435,996	307,742
Extracts for tanning							
Quebracho	Lb.	135,498,346	4,508,237	92,544,284	2,583,795	105,465,199	3,685,916
All other	Lb.	6,036,726	171,280	7,046,032	192,443	3,877,001	137,547
Starch	Lb.	13,382,414	420,538	13,159,898	487,964	11,395,416	485,372
Mineral oil							
Crude petroleum	Gal.	3,444,631,182	53,882,278	3,970,449,569	100,711,960	3,071,789,491	99,141,783
Tops and distillates	Gal.	32,988,174	1,690,259	13,382,867	949,215	7,547,559	552,038
Gasoline, naphthas	Gal.	190,894,393	14,803,170	143,772,734	12,996,817	146,689,383	14,620,386
Illuminating oil	Gal.	301,483	55,657	3,357,544	238,185	757,149	125,462
Lubricating oils	Gal.	1,219,083	196,366	451,987	87,003	1,538,263	278,400
Paraffin and paraffin wax	Lb.	12,843,022	559,087	12,866,607	645,365	13,781,546	938,512
Asphalt and bitumen	Ton	129,138	1,079,906	145,211	1,203,159	104,998	874,540
Lime and limestone crude	100 lb.	507,139	428,909	46,960,959	382,961	31,367,235	270,889
Kaolin, china and paper clay	Ton	279,166	3,050,099	315,437	3,189,846	305,725	2,927,117
Other clays	Ton	67,656	619,727	81,390	816,038	50,140	597,115
Chalk, unmanufactured	Ton	122,983	175,730	107,081	131,101	92,971	109,672
manufacturers of	Lb.	9,462,492	122,866	16,718,125	142,757	15,954,165	142,231
Pyrites or sulphuret of iron	Ton	259,926	1,248,980	243,237	582,794	270,157	753,125
Talcum, steatite, French chalk	Lb.	38,811,812	409,600	36,398,433	356,629	38,939,965	415,275
Salt	100 lb.	172,069,989	1,132,113	199,223,683	343,391	150,758,072	292,420
Mineral wax	Lb.	5,000,597	216,906	3,068,819	207,833	4,996,930	302,947
Chrome ore	Lb.	128,763	1,123,120	118,343	1,095,603	136,891	1,117,661
Aluminum ore, crude bauxite	Ton	119,020	593,882	201,974	909,493	337,870	1,539,850
Antimony ore	Lb.	2,094,095	44,721	1,797,950	62,999	4,193,131	46,834
Quicksilver	Lb.	1,568,551	901,031	905,678	520,870	1,388,446	1,048,638
Zinc dust	Lb.	66,044	16,714	186,363	29,120	288,152	37,385
Chemicals and allied products, free	...	...	86,522,790	...	89,312,715	...	92,204,417
(total) duty	...	...	36,871,605	...	32,361,330	...	38,019,957
Chemicals (total)	...	...	47,100,600	...	20,119,024	...	18,994,704
Coal-tar chemicals (total)	...	...	17,273,682	...	...	...	...
Coal-tar products, crude:							
Benzene and toluene	Lb.	896,561	29,864	363,742	12,632	1,348,947	38,036
Dead or creosote oil	Gal.	64,199,636	10,071,393	89,687,784	13,403,689	80,593,570	10,376,236
Naphthalene	Lb.	21,036,458	578,563	5,266,708	96,491	1,979,612	26,593
Tar and pitch	Bbl.	14,775	46,825	17,209	52,351	14,300	53,605
Other crude coal-tar products	...	...	807,641	...	471,730	...	422,682
Intermediates							
Acids	Lb.	80,505	94,269	295,281	77,423	273,968	79,255
Other intermediate products	Lb.	2,598,281	513,692	3,811,819	729,617	2,117,163	954,114
Finished products							
Alizarin and derivatives	Lb.	290,130	403,612	151,609	214,394	34,305	70,631
Colors or dyes, n.e.s.	Lb.	...	...	3,433,946	4,459,456	4,954,255	6,341,431

Imports of Chemicals and Allied Products—Continued

		12 Months Ended December				11 Months Ended November	
		1923		1924		1925	
		Quantity	Value	Quantity	Value	Quantity	Value
Colors, dyes, stains, color acids, and color bases, n.e.s.	Lb.	3,252,382	4,424,311	3,433,946	4,459,456	4,954,255	6,341,431
Imported from							
Germany	Lb.	1,580,403	1,945,814	1,652,784	2,079,059	2,569,686	3,364,421
Switzerland	Lb.	857,466	1,331,075	1,118,215	1,523,829	1,559,669	1,908,887
United Kingdom	Lb.	108,410	111,969	107,510	102,526	162,256	135,588
Other countries	Lb.	706,103	1,035,453	287,116	412,401	302,297	388,410
Coal-tar medicinals	Lb.	68,127	212,255	92,203	255,975	101,521	239,281
Other finished coal-tar products	Lb.	14,885	51,303	12,080	14,084	11,697	31,729
Other chemicals							
Acids and anyhdrides							
Arsenious acid or white arsenic	Lb.	21,149,545	1,985,400	17,703,996	1,591,138	18,160,977	1,060,303
Citric	Lb.	820,370	250,845	744,624	206,107	675,810	159,337
Formic	Lb.	1,275,705	95,405	1,543,998	122,119	1,399,663	98,968
Oxalic	Lb.	2,629,297	206,861	3,155,591	178,902	2,504,882	114,140
Sulphuric	Lb.	23,508,494	198,083	15,249,265	130,552	32,524,810	217,797
Tartaric	Lb.	2,653,919	641,597	2,986,080	617,140	3,563,677	698,799
All other — free	Lb.	1,716,584	17,916	355,022	5,339	1,503,674	19,632
All other — dut.	Lb.	2,580,966	347,639	2,682,864	351,112	4,654,517	618,866
lcohols, including fusel oil	......	....	1,239,358	....	504,075	....	671,851
Ammonia compounds, n.e.s.							
Muriate of ammonia	Lb.	6,056,902	325,179	9,791,100	453,783	9,986,687	421,986
Nitrate	Lb.	19,915,953	1,297,924	3,747,531	209,399	9,692,153	483,367
All other	Lb.	1,874,439	104,977	3,747,531	209,399	9,692,153	483,367
Arsenic sulphide (realgar and orpiment)	Lb.	2,194,540	268,311	1,936,495	78,348	1,966,169	87,285
Barium compounds	Lb.	7,954,717	298,737	467,449	45,246	875,806	59,023
Cobalt oxide	Lb.	258,574	511,903	14,049,906	353,628	18,625,211	281,614
Copper sulphate	Lb.	....	....	226,703	440,898	243,867	463,580
Lime							
Chlorinated, or bleaching powder	Lb.	1,395,545	50,532	1,267,427	54,644	2,005,636	58,423
Citrate	Lb.	1,672,604	200,143	2,505,444	256,807	3,037,504	303,197
Glycerin	Lb.	15,142,802	1,507,664	15,927,701	1,729,461	19,276,335	2,292,964
Iodine, crude	Lb.	·274,238	887,460	....	....	214,201	771,604
Potassium compounds							
Cyanide	Lb.	2,464,462	199,261	2,918,536	239,749	2,095,217	202,450
Carbonate	Lb.	10,949,977	579,095	6,277,813	243,545	7,276,496	321,010
Hydroxide	Lb.	10,857,354	686,710	12,657,186	700,242	11,375,562	680,181
Nitrate	Ton	2,747	137,228	689	54,628	8,128	429,001
Bitartrate, crude, argols	Lb.	19,803,621	1,512,011	16,743,852	1,094,451	22,073,740	1,505,825
Cream of tartar	Lb.	....	....	1,525,894	166,596	332,697	47,208
Potassium chlorate and perchlorate	Lb.	....	....	7,487,449	309,107	11,677,271	474,865
Other potassium compounds	Lb.	23,171,018	1,684,311	6,341,178	439,571	9,329,884	579,104
Sodium compounds							
Cyanide	Lb.	29,645,744	2,435,299	29,881,115	2,658,006	27,873,694	2,429,483
Ferrocyanide	Lb.	1,147,171	186,601	3,153,250	267,199	1,376,544	98,051
Nitrite	Lb.	4,685,501	209,026	4,578,091	180,816	1,189,485	49,360
All other, n.e.s. — free	Lb.	29,873,807	466,666	15,609,590	156,598	14,633,201	187,612
All other, n.e.s. — dut.	......	....	940,854	....	445,170	....	494,217
All other chemicals, n.e.s. — free	......	....	1,288,547	....	736,344	....	688,929
All other chemicals, n.e.s. — dut.	......	....	3,447,734	....	2,223,984	....	2,772,045
Paints, pigments, and varnishes (total)	......	....	3,306,920	....	2,822,702	....	2,968,802
Mineral earth pigments							
Ochers and siennas ... dut.	Lb.	21,022,483	343,938	19,657,287	249,689	18,538,354	251,747
Other ... dut.	Lb.	78,657,524	994,704	76,662,149	835,218	77,291,383	868,740
Chemical pigments							
Zinc pigments ... dut.	Lb.	22,690,529	948,018	17,265,086	795,131	14,621,528	672,418
All other ... dut.	......	....	551,623	....	491,989	....	669,761
Paints, stains, and enamels ... dut.	Lb.	1,016,684	389,337	1,086,758	376,752	1,434,442	460,278
Varnishes ... dut.	Gal.	21,621	79,300	30,755	73,923	15,550	45,858
Fertilizers (total)	Ton	1,857,866	63,881,361	1,894,634	66,531,495	2,107,073	73,354,332
Nitrogeneous							
Calcium cyanamid	Ton	68,532	3,672,398	75,558	3,687,794	88,224	4,238,342
Calcium nitrate	Ton	9,211	366,340	7,682	347,304	7,705	324,996
Sodium nitrate	Ton	891,679	41,955,770	986,608	47,169,496	1,069,208	50,430,343
Sulphate of ammonia	Ton	3,539	204,624	6,000	342,000	21,565	1,210,027
Guano	Ton	....	....	25,245	754,683	16,900	706,698
Dried blood	Ton	....	....	7,191	403,865	7,944	443,695
Tankage	Ton	....	....	23,571	676,201	27,344	908,639
Phosphate							
Bone phosphate	Ton	56,326	1,732,749	22,142	706,727	22,075	636,351
Other phosphate material	Ton	11,010	149,895	22,886	257,692	11,286	169,645
Potash fertilizers							
Chloride, crude (muriate of potash)	Ton	135,497	4,116,180	128,803	3,972,366	142,613	4,631,381
Sulphate, crude	Ton	63,578	2,576,469	75,657	2,856,503	62,877	2,451,007
Kainite	Ton	160,211	924,131	154,954	913,816	163,067	1,027,812
Manure salts	Ton	273,344	2,957,503	226,144	2,217,974	341,913	3,257,385
Other potash-bearing substances	Ton	32,826	412,111	46,461	479,585	19,938	225,860
All other fertilizers	Ton	34,612	943,959	38,157	660,419	35,527	833,044
Explosives							
Azides, fulminates, dynamite, etc., and powder from country imposing duty	......	....	....	....	39,857	....	184,150
Firecrackers	Lb.	4,298,893	567,610	5,193,314	818,873	4,038,533	822,150
Fireworks and ammunition	Lb.	563,407	134,989	464,589	99,181	264,052	61,567
Soap							
Castile	Lb.	1,861,576	187,228	1,740,562	206,874	1,637,046	205,038
Toilet	Lb.	903,314	280,999	908,514	316,418	951,239	339,813
All other	Lb.	2,572,248	257,149	1,944,624	213,564	2,210,912	268,848
Perfume materials	Lb.	....	1,290,382	1,059,686	730,920	....	2,125,722
Cosmetics, powders, creams	Lb.	1,348,584	711,050	....	2,904,896	1,040,269	657,861
Cellulose products	Lb.	308,800	59,982	1,351,834	1,694,879	1,301,110	1,582,805
Rubber and similar gums and manufactures of	......	....	189,757,835	....	179,868,652	....	371,271,377
Rubber, crude and milk of	Lb.	692,483,377	185,060,304	735,980,070	174,244,917	798,142,346	364,649,146
Telutong	Lb.	10,226,281	853,308	13,809,583	1,237,100	14,279,147	1,545,999
Balata	Lb.	1,567,959	898,524	1,038,376	568,456	980,178	486,523
Gutta-percha	Lb.	2,043,100	375,167	3,154,731	463,610	3,303,056	567,629
Guayule	Lb.	....	....	2,959,983	522,806	7,438,872	1,526,698
Other crude	Lb.	16,536,687	1,284,720	12,167,633	417,046	20,427,969	781,961
Rubber belting	Lb.	583,306	373,466	582,096	397,967	680,078	510,895
Other manufactures	......	....	912,346	....	2,016,850	....	1,202,526

Comparative Prices in the New York Market, 1925

The following prices refer to round lots in the New York market. Where it is the trade custom to sell f.o.b. producing points, the quotations are given on that basis and are so designated. The figures show the opening price, the high, the low and the closing price for 1925.

Industrial Chemicals

		Jan. 1	High	Low	Dec. 31
Acetone, drums	lb.	$0.12	$0.12	$0.10	$0.12
Acid, acetic, 28% bbl 100	lb.	3.12	3.25	3.00	3.25
Boric, bbl	lb.	.09	.10½	.08	.09
Citric, dom., kegs	lb.	.46½	.48	.45½	.45½
Citric, imp., kegs	lb.	.45½	.46½	.45	.46½
Lactic, 44%, tech., light, bbl	lb.	.13½	.13½	.13½	.13½
22% tech., light, bbl	lb.	.06½	.06½	.06½	.06½
Muriatic, 18° tanks 100	lb.	.80	.80	.80	.80
Nitric, 36° carboys 100	lb.	4.00	5.00	4.00	5.00
Oxalic, crystals, bbl	lb.	.10½	.11	.10½	.10½
Sulphuric, 60°, tanks	tons	8.00	9.50	8.00	9.50
Tartaric, imp., powd., bbl	lb.	.26	.28	.26	.28
Tartaric, domestic, bbl	lb.	.29	.30	.28	.29
Alcohol Ethyl, 190 p'f. U.S.P., bbl	gal.	4.92	4.94	4.90	4.94
Alcohol, denatured, 190 proof					
No. 1 special dr	gal.	.55	.57½	.48½	.53½
No. 5, 188 proof, dr	gal.	.54	.56½	.47½	.53½
Alum., ammonia, lump, bbl	lb.	.03½	.03½	.03½	.03½
Potash, lump, bbl	lb.	.02¾	.03	.02¾	.02¾
Aluminum sulphate, com., bags 100	lb.	1.35	1.35	1.35	1.35
Aqua ammonia, 26°, tanks	lb.	.06½	.06½	.03	.03½
Ammonia, anhydrous, cyl	lb.	.28	.30	15	.15
Ammonium carbonate, powd. tech., casks	lb.	.09	.09	.08½	.08¾
Ammonium sulphate, wks 100	lb.	2.75	3.00	2.60	2.90
Amylacetate tech., drums	gal.	3.75	3.75	2.50	2.50
Arsenic, white, powd., bbl	lb.	.06½	.06½	.03	.03½
Arsenic, red, powd., kegs	lb.	.14¾	.14¾	.12	.12
Barium carbonate, bbl	ton	54.00	56.00	43.00	45.00
Barium chloride, bbl	ton	64.00	70.00	55.00	59.00
Barium, nitrate, casks	lb.	.07¾	.08	.07½	.07½
Bleaching powd., f.o.b. wks., drums 100	lb.	1.90	2.00	1.90	2.00
Borax, bbl	lb.	.05	.05½	.05	.05
Calcium acetate, bags 100	lb.	3.00	3.25	2.75	3.25
Calcium arsenate, dr	lb.	.08	.08	.06	.07
Calcium carbide drums	lb.	.05	.05½	.04½	.05½
Calcium chloride, fused, dr. wks	ton	21.00	21.00	21.00	21.00
Carbon bisulphide, drums	lb.	.06	.06	.05½	.05½
Carbon tetrachloride drums	lb.	.06¾	.07	.06½	.06½
Chlorine, liquid, tanks, wks	lb.	.04	.04	.04	.04
Cobalt, oxide bbl	lb.	2.10	2.10	2.10	2.10
Copperas, bulk, f.o.b. wks	ton	15.00	15.00	12.50	13.00
Copper carbonate, bbl	lb.	.16¾	.17	.16½	.16¾
Copper sulphate, bbl 100	lb.	.04¾	.04¾	.04½	.04½
Imp. bbl 100	lb.	.04½	.04¾	.04½	.04½
Cream of tartar, bbl	lb.	.20½	.22	.20½	.21
Epsom salt, dom., tech., bbl 100	lb.	1.75	1.75	1.50	1.50
Epsom salt, imp., tech., bags 100	lb.	1.35	1.35	1.25	1.25
Ethyl acetate, 85% drums	gal.	.92	.92	.82	.82
Formaldehyde, 40%, bbl	lb.	.09	.09	.09	.09
Fusel oil, crude, drums	gal.	3.10	3.10	1.80	1.80
Glaubers salt, bags 100	lb.	.90	.90	.75	.75
Glycerine, c.p., drums, extra	lb.	.19	.25	.19	.25
Lead:					
White, basic carbonate, dry, casks	lb.	.11	.11½	.10¾	.10¾
White, basic sulphate, casks	lb.	.10½	.11	.10	.10
Lead acetate, white crys., bbl	lb.	.15½	.15½	.14½	.14½
Lead arsenate, powd., bbl	lb.	.16	.17	.12½	.13
Lithopone, bags	lb.	.06	.06	.06	.06
Magnesium carb., tech., bags	lb.	.07	.07	.06½	.06½
Methanol, 95%, dr	gal.	.70	.70	.57	.57
Methanol, 97%, dr	gal.	.72	.72	.59	.59
Nickel salt, double, bbl	lb.	.10	.10	.10	.10
Nickel salts, single, bbl	lb.	.10½	.10½	.10½	.10½
Phosphorus, red, cases	lb.	.70	.90	.68	.68
Phosphorus, yellow, cases	lb.	.37½	.37½	.32	.35
Potassium bichromate, casks	lb.	.08¾	.08½	.08	.08
Potassium carbonate, 80-85%, calcined, casks	lb.	.06	.06¼	.05¾	.06
Potassium chlorate, powd	lb.	.06¾	.09	.06¾	.08¼
Potassium hydroxide (caustic potash) drums	lb.	.07¼	.07½	.07¼	.07¼
Potassium muriate, 80% bags	ton	34.55	34.90	34.55	34.90
Potassium nitrate, bbl	lb.	.06	.06¾	.06	.06¾
Potassium permanganate, drums	lb.	.14½	.15	.14½	.14½
Potassium prussiate, red, casks	lb.	.36½	.38	.36	.37½
Potassium prussiate, yellow, caks	lb.	.16¾	.18½	.16¾	.18¾
Salammoniac, white, imp., casks	lb.	.05¾	.06	.05½	.05½
Salsoda, bbl 100	lb.	1.20	1.20	.95	.95
Soda ash, light, 58% bags, contract 100	lb.	1.38	1.38	1.38	1.38
Soda, caustic, 76%, solid, drums contract 100	lb.	3.10	3.10	3.10	3.10
Sodium acetate, works, bbl	lb.	.05	.06	.04½	.04¾
Sodium bicarbonate, 330-lb. bbl 100	lb.	1.75	2.00	1.75	2.00
Sodium bichromate, casks	lb.	.06½	.06¾	.06	.06¼
Sodium chlorate, kegs	lb.	.06½	.06½	.06¼	.06¼
Sodium cyanide, cases, dom	lb.	.22	.22	.20	.20
Sodium cyanide, imp. cases	lb.	.19	.21	.18	.19
Sodium fluoride, bbl	lb.	.08¾	.09	.08¾	.08¾
Sodium nitrate, bags 100	lb.	2.47½	2.69	2.40	2.63
Sodium nitrate, casks	lb.	.09	.09	.08¾	.09
Sodium phosphate, dibasic, bbl	lb.	.03½	.03½	.03½	.03½
Sodium prussiate, yel. drums	lb.	.09½	.11	.09½	.10½
Sodium silicate (40°, drums) 100	lb.	.75	.75	.75	.75
Sodium sulphide, fused, 60-62% drums 100	lb.	$2.75	$3.00	$2.75	$3.00
Sodium sulphite, crys., bbl	lb.	.03¾	.03½	.03	.03
Strontium nitrate, powd., bbl	lb.	.09¾	.09½	.09	.09
Sulphur, crude at mine, bulk	ton	14.00	17.00	14.00	17.00
Sulphur, flour, bag 100	lb.	2.25	2.70	2.25	2.70
Tin bichloride, bbl	lb.	.15½	.17¾	.14¾	.17¾
Tin oxide, bbl	lb.	.58	.66	.57	.66
Tin crystals, bbl	lb.	.38½	.43	.37	.43
Zinc chloride, gran., bbl	lb.	.06	.07	.06	.07
Zinc oxide, lead free, bag	lb.	.07¾	.07½	.07¼	.07¼
5% lead sulphate, bags	lb.	.06⅞	......	......	......
Zinc sulphate, bbl 100	lb.	3.25	3.25	3.00	3.00

Coal-Tar Products

		Jan. 1	High	Low	Dec. 31
Alpha-naphthol, crude, bbl	lb.	$0.60	$0.60	$0.60	$0.60
Alpha-naphthol, ref., bbl	lb.	.75	.85	.75	.85
Alpha-naphthylamine, bbl	lb.	.35	.35	.35	.35
Aniline oil, drums, extra	lb.	.16	.17	.16	.16
Aniline salts, bbl	lb.	.22	.23	.22	.22
Anthracene, 80%, drums	lb.	.70	.70	.60	.60
Anthracquinone, 25%, drums	lb.	.65	......	......	......
Benzaldehyde, tech., carboys	lb.	.70	.75	.70	.70
Benzene, 90%, tanks, works	gal.	.23	.24	.21	.24
Benzidine base, bbl	lb.	.78	.78	.72	.72
Benzoic acid, U.S.P., kegs	lb.	.70	.70	.56	.56
Benzoate of soda, U.S.P., bbl	lb.	.62	.62	.59	.50
Benzyl chloride, tech., drums	lb.	.25	.25	.25	.25
Beta-naphthol, tech., bbl	lb.	.24	.24	.22	.22
Beta-naphthylamine, tech	lb.	.65	.65	.65	.65
Creosol, U.S.P., drums	lb.	.22	.24	.20	.20
Cresylic acid, 97%, works drums	gal.	.59	.60	.53	.59
95-97%, drums, works	gal.	.55	.52	.52	.57
Diethylaniline, drums	lb.	.58	.58	.58	.58
Dimethylaniline, drums	lb.	.36	.36	.32	.32
Dinitrophenol, bbl	lb.	.32	.34	.31	.31
Dinitrotoluen, bbl	lb.	.19	.20	.18	.18
Diphenylamine, bbl	lb.	.48	.48	.48	.48
H-acid, bbl	lb.	.70	.70	.68	.68
Monochlorbenzene, drums	lb.	.08	.08	.07½	.07½
Monoethylaniline, drums	lb.	.90	1.05	.90	1.05
Naphthalene, flake, bbl	lb.	.05½	.06	.05½	.05¾
Naphthalene, balls, bbl	lb.	.06½	.06¾	.06½	.06¾
Naphthionate of soda, bbl	lb.	.58	.58	.55	.55
Naphthionic acid, crude, bbl	lb.	.62	.62	.55	.55
Nitrobenzene, drums	lb.	.09	.09	.09	.09
N-W acid, bbl	lb.	1.10	1.10	.95	.95
Ortho-amidophenol, kegs	lb.	2.40	2.40	2.15	2.15
Ortho-dichlorbenzene, drums	lb.	.10	.10	.09	.09
Ortho-nitrophenol, bbl	lb.	1.00	1.00	.50	.50
Ortho-nitrotoluene, drums	lb.	.09	.15	.09	.14
Ortho-toluidine, bbl	lb.	.17	.25	.17	.25
Para-aminophenol, base, kegs	lb.	1.15	1.15	1.15	1.15
Para-dichlorbenzene, bbl	lb.	.17	.17	.17	.17
Para-nitroaniline, bbl	lb.	.65	.65	.52	.52
Para-nitrotoluene, bbl	lb.	.40	.40	.30	.30
Para-phenylenediamine, bbl	lb.	1.30	1.30	1.25	1.25
Para-toluidine, bbl	lb.	.75	.75	.55	.55
Phthalic anhydride, bbl	lb.	.25	.25	.18	.18
Phenol, U.S.P., dr	lb.	.23	.25	.21	.21
Picric acid, bbl	lb.	.20	.30	.20	.30
Resorcinol, tech., kegs	lb.	1.30	1.35	1.30	1.35
R-salt, bbl	lb.	.50	.50	.45	.45
Salicylic acid, tech., bbl	lb.	.32	.33	.32	.33
Salicylic acid, U.S.P., bbl	lb.	.35	.35	.34	.34
Solvent naphtha, crude, tanks	gal.	.21	.35	.21	.35
Sulphanilic acid, crude, bbl	lb.	.16	.16	.16	.16
Toluidine, mixed, kegs	lb.	.30	.32	.30	.31
Toluene, tank cars, works	gal.	.26	.35	.26	.35
Xylidine drums	lb.	.40	.40	.38	.38
Xylene, 5%, drums	gal.	.38	.55	.38	.55
Xylene, com., tanks	gal.	.25	.36	.25	.36

Oils and Fats

		Jan. 1	High	Low	Dec. 31
Castor oil, No. 3, bbl	lb.	$0.17	$0.17	$0.15	$0.15
Chinawood oil, bbl	lb.	.15½	.15½	.12	.13
Cocoanut oil, Ceylon, tanks, N. Y	lb.	.10⅞	.12	.09¼	.11
Corn oil, Crude, tanks (f.o.b. mill)	lb.	.10½	.11½	.09½	.09¾
Cottonseed oil, crude (f.o.b. mill), tanks	lb.	.09¾	.11	.08¼	.09
Linseed oil, raw, car lots, bbl	gal.	1.15	1.17	.90¾	.90¾
Palm, Lagos, casks	lb.	.09⅞	.11¼	.09	.09¼
Niger, casks	lb.	.08⅞	.10¼	.08	.08¼
Peanut oil, crude, tanks (mill)	lb.	.11½	.12	.09¾	.10¼
Rapeseed oil, refined, bbl	gal.	.97	.98	.93	.95
Sesame, bbl	lb.	.14½	.15½	.14½	.15
Soya bean tank (f.o.b. coast)	lb.	.11⅞	.12	.10¼	.10⅜
Sulphur (olive foots), bbl	lb.	.09⅞	.10	.08	.08⅞
Cod, Newfoundland, bbl	gal.	.62	.64	.62	.63
Menhaden, light pressed, bbl	gal.	.70	.78	.67	.67
Crude, tanks (f.o.b. factory)	gal.	.55	.55	.50	.55
Grease, yellow, loose	lb.	.09¾	.10½	.08¼	.08⅜
Oleo Stearine	lb.	.12	.16¼	.10¼	.12¼
Red oil, distilled, d.p. bbl	lb.	.11¼	.12¼	.09	.11
Tallow, extra, loose	lb.	.11	.11½	.08¾	.09¾

Miscellaneous

		Jan. 1	High	Low	Dec. 31
Paraffine wax, crude, 124 m.p. bg	lb.	$0.05⅞	$0.05¾	$0.04½	$0.05¼
Rosin, B-D, bbl 280	lb.	7.65	16.45	7.65	13.60
Turpentine, spirits, bbl	gal.	.84	1.19	.84	1.01

Current Prices in the New York Market

For Chemicals, Oils and Allied Products

The following prices refer to round lots in the New York Market. Where it is the trade custom to sell f.o.b. works, quotations are given on that basis and are so designated. Prices are corrected to January 16.

Industrial Chemicals

		Current Price	Last Month	Last Year
Acetone, drums	lb.	$0.12 -$0.13	$0.12 -$0.13	$0.15 -$0.16
Acid, acetic, 28%, bbl.	cwt.	3.25 - 3.50	3.12 - 3.37	3.12 - 3.37
Boric, bbl	lb.	.08½- .10	.08½- .10	.09 - .09½
Citric, kegs	lb.	.45½- .47	.45½- .47	.45½- .47
Formic, bbl	lb.	.10 - .11½	.10 - .11	.10½- .10¾
Gallic, tech., bbl	lb.	.45 - .50	.45 - .50	.45½- .47
Hydrofluoric 30% carb.	lb.	.06 - .07	.06 - .07	.06½- .07
Lactic, 44%, tech., light, bbl.	lb.	.13½- .14	.13½- .14	.13½- .14
22%, tech., light, bbl	lb.	.06 - .06½	.06½- .07	.06½- .07
Muriatic, 18°, tanks	cwt.	.80 - .85	.80 - .85	.80 - .85
Nitric, 36°, carboys	cwt.	.05 - .05¼	.05 - .05¼	.04 - .04½
Oleum, tanks, wks.	ton	17.50 -20.00	17.50 -20.00	16.00- 17.00
Oxalic, crystals, bbl.	lb.	.10¾- .11	.10¾- .11	.10½- .11
Phosphoric, tech., c'bys	lb.	.07 - .07½	.07 - .07½	.07¾- .08
Sulphuric, 60°, tanks	ton	8.50 - 9.50	8.50 - 9.50	8.00 - 9.00
Tannic, tech., bbl	lb.	.35 - .40	.35 - .40	.45 - .50
Tartaric, powd., bbl	lb.	.27½- .30	.27½- .30	.27 - .29
Tungstic, bbl	lb.	1.00 - 1.20	1.00 - 1.20	1.20 - 1.25
Alcohol, ethyl, 190 p'f. U.S.P. bbl	gal.	4.94 - 5.04	4.94 - 5.04	4.89 - .....
Alcohol, Butyl, dr	lb.	.20 - .21	.217- .227	.27 - .30
Denatured, 190 proof				
No. 1 special dr	gal.	.53½-.....	.54½-.....	.55 -.....
No. 5, 188 proof, dr	gal.	.53½-.....	.53½-.....	.55 -.....
Alum, ammonia, lump, bbl	lb.	.03¼- .04	.03¼- .04	.03½- .04
Chrome, bbl	lb.	.05½- .05¾	.05½- .05¾	.05½- .06
Potash, lump, bbl	lb.	.02¾- .03½	.02¾- .03½	.02¾- .03½
Aluminum sulphate, com., bags	cwt.	1.40 - 1.45	1.40 - 1.45	1.40 - 1.45
Iron free, bg	cwt.	2.00 - 2.10	2.00 - 2.10	2.40 - 2.45
Aqua ammonia, 26°, drums	lb.	.03 - .04	.05 - .06	.06½- .06¾
Ammonia, anhydrous, cyl	lb.	.13 - .15	.15 - .17	.28 - .30
Ammonium carbonate, powd. tech., casks	lb.	.08½- .10	.08½- .10	.12½- .12¾
Nitrate, tech., casks	lb.	.08 - .08½	.08 - .08½	.09 - .10
Sulphate, wks	cwt.	2.95 -	2.95 -	2.75 - .....
Amylacetate tech., drums	gal.	2.35 - 2.50	2.45 - 2.50	3.25 - 3.50
Antimony Oxide, bbl	lb.	.18½- .19	.18½- .19	.14¾- .16
Arsenic, white, powd., bbl	lb.	.03½- .04½	.03¾- .04¼	.05¾- .06
Red, powd., kegs	lb.	.12 - .12½	.12½- .13	.14¾- .15¼
Barium carbonate, bbl	ton	45.00 -54.00	45.00 -54.00	54.00 -58.00
Chloride, bbl	ton	60.00 -62.00	58.00 -66.00	63.00 -68.00
Nitrate, cask	lb.	.08 - .08½	.07¼ - .07½	.07½- .08
Blanc fixe, dry, bbl	lb.	.03¾- .04	.03¾- .04	.03¾- .04
Bleaching powder, f.o.b., wks., drums	cwt.	2.00 - 2.10	2.00 - 2.10	1.90 - .....
Borax, bbl	lb.	.05 - .05¼	.05 - .05¼	.05 - .05¼
Bromine, cs	lb.	.45 - .47	.45 - .47	.44 - .45
Calcium acetate, bags	cwt.	3.25 - 3.50	3.00 - 3.05	3.00 - 3.05
Arsenate, dr	lb.	.07 - .08	.07 - .08	.08 - .09
Carbide drums	lb.	.05½- .06	.05½- .06	.05 - .05¼
Chloride, fused, dr., wks	ton	21.00 -	21.00 -	21.00 - .....
Phosphate, bbl	lb.	.07 - .07½	.07 - .07½	.06¾- .07¼
Carbon bisulphide, drums	lb.	.06 - .06½	.06 - .06½	.06 - .06½
Tetrachloride drums	lb.	.06¾- .06½	.07 - .07¼	.06¾- .07
Chlorine, liquid, tanks, wks.	lb.	.04 - .04½	.04 - .04½	.04½- .....
Cylinders	lb.	.05½- .08	.05½- .08	.05½- .08
Cobalt oxide, cans	lb.	2.10 - 2.20	2.10 - 2.20	2.10 - 2.25
Copperas, bgs., f.o.b. wks	ton	13.50 -11.00	13.50- 14.00	15.00 -16.00
Copper carbonate, bbl	lb.	.17 - .18	.17 - .18	.16½- .17
Cyanide, tech., bbl	lb.	.49 - .50	.49 - .50	.49 - .50
Sulphate, bbl	cwt.	4.50 - 4.60	4.50 - 4.60	4.50 - 4.65
Cream of tartar, bbl	lb.	.21½- .22	.21½- .22	.20¾- .21
Epsom salt, dom., tech., bbl	cwt.	1.75 - 2.15	1.75 - 2.00	1.75 - 2.00
Imp., tech., bags	cwt.	1.30 - 1.40	1.30 - 1.40	1.35 - 1.40
Ethyl acetate, 85% drums	gal.	.80 - 82.	.82 - .85	.92 - .95
99%, dr	gal.	1.03 -	1.05 -	1.08 - 1.10
Formaldehyde, 40%, bbl	lb.	.09 - .09½	.09 - .09½	.09 - .09½
Furfural, dr	lb.	.17 - .20	.20 - .23	.23 - .....
Fusel oil, crude, drums	gal.	1.80 - 1.90	2.25 - 2.30	2.90 - 3.00
Refined, dr	gal.	3.10 - 3.20	3.25 - 3.50	4.00 - 4.50
Glaubers salt, bags	cwt.	1.15 - 1.25	1.15 - 1.25	1.20 - 1.40
Glycerine, c.p., drums, extra	lb.	.25 - .26	.25 - .26	.19 - .19½
Lead:				
White, basic carbonate, dry, casks	lb.	.10¾-	.10¾-	.11 - .....
White, basic sulphate, sck	lb.	.10 -	.10 -	.10½- .....
Red, dry, sck	lb.	.12½-	.12½-	.13½- .....
Lead acetate, white crys., bbl	lb.	.14½- .15	.14½- .15	.15½- .....
Lead arsenate, powd., bbl	lb.	.13 - .14	.13 - .14	.16 - .18
Lime, chem., bulk	ton	8.50 -	8.50 -	8.50 - .....
Litharge, pwd., csk	lb.	.11¾-	.11¾-	.13½- .....
Lithopone, bags	lb.	.05½- .06	.06 - .06¼	.06 - .06½
Magnesium carb., tech., bags	lb.	.06½- .07	.06½- .07	.07 - .08
Methanol, 95%, dr	gal.	.57 - .62	.57 - .62	.70 - .72
97%, dr	gal.	.59 - .64	.59 - .64	.72 - .74
Nickel salt, double, bbl	lb.	.10 - .10½	.10 - .10½	.09 - .10
Single, bbl	lb.	.10½- .11	.10½- .11	.10 - .11
Orange mineral, csk	lb.	.14 -	.14 -	.16½- .....
Phosphorus, red, cases	lb.	.68 - .70	.70 - .75	.70 - .75
Yellow, cases	lb.	.34 - .36	.34 - .36	.37½- .40
Potassium bichromate, casks	lb.	.08½- .08¾	.08½- .08¾	.08½- .08¾
Carbonate, 80-85%, calc., csk	lb	.06 -	.05½- .06	.06 - .06¼
Chlorate, powd	lb.	.08½- .09	.08½- .09	.06½- .08
Cyanide, cs	lb.	.52 - .54	.55 - .58	.47 - .62
First sorts, csk	lb.	$0.08¾-$0.09	$0.08¾-$0.09	$0.08½-$0.08¾
Hydroxide (c'stic potash) dr.	lb.	.07½- .07¾	.07½- .07¾	.07¼- .07½
Muriate, 80% bgs	ton	34.90 -	34.90 -	34.55 - .....
Nitrate, bbl	lb.	.06¼- .06½	.06¼- .06½	.06 - .07¾
Permanganate, drums	lb.	.14½- .15	.14 - .15	.14½- .15
Prussiate, yellow, casks	lb.	.18¾- .18½	.18 - .18¼	.18½- .18¾
Sal ammoniac, white, casks	lb.	.06 - .07	.05¾- .07	.06 - .06¼
Salsoda, bbl	cwt.	1.10 - 1.30	1.20 - 1.40	1.20 - 1.40
Salt cake, bulk	ton	17.00 -18.00	15.00 -18.00	16.00 -17.00
Soda ash, light, 58%, bags, contract	cwt.	1.38 -	1.38 -	1.38 - .....
Dense, bags	cwt.	1.45 - 1.55	1.45 - 1.55	1.45 - 1.55
Soda, caustic, 76%, solid, drums, contract	cwt.	3.10 -	3.10 -	3.10 - .....
Acetate, works, bbl	lb.	.04¾- .05	.04¾- .05	.05 - .05¼
Bicarbonate, bbl	cwt.	2.00 - 2.25	2.00 - 2.25	1.75 - 2.00
Bichromate, casks	lb.	.06¾- .06½	.06½- .06¾	.06¾- .06¾
Bisulphate, bulk	ton	4.50 - 5.00	4.50 - 5.00	6.00 - 7.00
Bisulphite, bbl	lb.	.03¾- .04	.03¾- .04	.04¼- .04½
Chlorate, kegs	lb.	.06¼- .06½	.06¼- .06½	.06½- .07
Chloride, tech	ton	12.00 -14.75	12.00- 14.75	12.00 -14.00
Cyanide, cases, dom	lb.	.18 - .22	.18 - .22	.19 - .22
Fluoride, bbl	lb.	.08¾- .09	.08¾- .09	.08¾- .09
Hyposulphite, bbl	lb.	.01¾- .02½	.01¾- .02½	.02¼- .02½
Nitrate, bags	cwt.	2.67 -	2.63 -	2.42½- .....
Nitrite, casks	lb.	.09½- .09¾	.08¾- .09	.09 - .09½
Phosphate, dibasic, bbl	lb.	.03¼- .03½	.03½- .03¾	.03½- .03¾
Prussiate, yel. drums	lb.	.10 - .10½	.10 - .10½	.10¼- .10½
Silicate (30°, drums)	cwt.	.75 - 1.15	.75 - 1.15	.75 - 1.15
Sulphide, fused, 60-62%, dr.	lb.	.03 - .03¼	.03 - .03¼	.02¾- .03
Sulphite, crys., bbl	lb.	.03 - .03¼	.02¾- .03	.02½- .03
Strontium nitrate, bbl	lb.	.08 - .08½	.08 - .09	.09½- .10
Sulphur, crude at mine, bulk	ton	17.00 -	17.00 -	14.00 -16.00
Chloride, dr	lb.	.05 - .05½	.04½- .05	.04½- .05
Dioxide, cyl	lb.	.09 - .10	.09 - .10	.08½- .09
Flour, bag	cwt.	2.70 - 3.00	2.25 - 2.80	2.25 - 2.35
Tin bichloride, bbl	lb.	.17¾-	.17¾-	.16½- .....
Oxide, bbl	lb.	.66 -	.62 -	.61 - .....
Crystals, bbl	lb.	.43 -	.43 -	.40½- .....
Zinc chloride, gran., bbl	lb.	.06½- .07	.07¾- .08	.06 - .07½
Carbonate, bbl	lb.	.09½- .10	.10¾- .11	.12 - .14
Cyanide, dr	lb.	.40 - .41	.40 - .41	.40 - .41
Dust, bbl	lb.	.09 - .10	.10 - .10½	.08 - .08½
Zinc oxide, lead free, bag	lb.	0.07¼-	0.07¼-	0.07½- .....
5% lead sulphate, bags	lb.	.07 -	.07 -	.06¾- .....
Sulphate, bbl	cwt.	3.00 - 3.50	3.00 - 3.50	3.50 - 3.75

Oils and Fats

		Current Price	Last Month	Last Year
Castor oil, No. 3, bbl	lb.	$0.15 -$0.15½	$0.15½-$0.16	$0.17 -$0.17½
Chinawood oil, bbl	lb.	.13¼- .13½	.13 - .13¼	.15½- .16
Coconut oil, Ceylon, tanks, N. Y.	lb.	.11½-	.12 -	.10½- .....
Corn oil crude, tanks, (f.o.b. mill)	lb.	.09¾-	0.9¾-	.10⅝- .....
Cottonseed oil, crude (f.o.b. mill), tanks	lb.	.09¾-	.08¾-	.09½- .....
Linseed oil, raw, car lots, bbl.	lb.	11.8 -	12.8 -	15.3 - .....
Palm, Lagos, casks	lb.	.09½-	.09½-	.09½- .....
Niger, casks	lb.	.08¾-	.08¾-	.08¾- .....
Palm Kernel, bbl	lb.	.11 - .11¼	.11 - .11¼	.10⅝- .....
Peanut oil, crude, tanks(mill)	lb.	.10 -	.10 -	.11½- .....
Perilla, bbl	lb.	.15½- .15¾	.15 - .15½	.14½- .....
Rapeseed oil, refined, bbl	gal.	.92 - .93	.93 - .94	.96 - .96½
Sesame, bbl	lb.	.15 - .15¼	.15 - .15½	.15 - .15½
Soya bean tank (f.o.b. Coast)	lb.	.10¾-	.10¾-	.11½- .....
Sulphur(olive foots), bbl	lb.	.08¾-	.09 -	.09¾- .....
Cod, Newfoundland, bbl	gal.	.64 - .66	.62 - .64	.64 - .66
Menhaden, light pressed, bbl	gal.	.72 - .74	.67 - .69	.70 - .72
Crude, tanks(f.o.b. factory)	gal.	.55 -	.55 -	.55 - .58
Whale, crude, tanks	lb.	..... -	.07½-	.....
Grease, yellow, loose	lb.	.09 -	.09 -	.09¼- .....
Oleo stearine	lb.	.12½- .13	.14 -	.11 - .....
Red oil, distilled, d.p. bbl	lb.	.11 - .11½	.11¼- .11½	.11 - .11½
Tallow, extra, loose	lb.	.09¾-	.09¾-	.10¼-

Coal-Tar Products

		Current Price	Last Month	Last Year
Alpha-naphthol, crude, bbl	lb.	$0.06 -$0.65	$0.60 -$0.65	$0.60 -$0.62
Refined, bbl	lb.	.90 - .95	.90 - .95	.75 - .80
Alpha-naphthylamine, bbl	lb.	.35 - .36	.35 - .36	.35 - .36
Aniline oil, drums, extra	lb.	.16 - .16½	.17 - .17½	.16 - .16½
Aniline salts, bbl	lb.	.20 - .22	.20 - .22	.20 - .21
Anthracene, 80%, drums	lb.	.60 - .65	.60 - .65	.65 - .70
Benzaldehyde, U.S.P., dr	lb.	1.15 - 1.20	1.15 - 1.20	1.50 - .....
Benzidine base, bbl	lb.	.72 - .74	.75 - .77	.78 - .80
Benzoic acid, U.S.P., kgs	lb.	.60 - .62	.60 - .62	.75 - .85
Benzyl chloride, tech, dr	lb.	.25 - .26	.30 - .31	.35 - .36
Benzol, 90%, tanks, works	gal.	.23 - .28	.24 - .29	.23 - .28
Beta-naphthol, tech., drums	lb.	.22 - .24	.22 - .24	.24 - .25
Cresol, U.S.P., dr	lb.	.18 - .20	.18 - .20	.23 - .25
Cresylic acid, 97%, dr., wks	gal.	.53 - .55	.53 - .55	.59 - .62
Diethylaniline, dr	lb.	.55 - .60	.55 - .57	.59 - .61
Dinitrophenol, bbl	lb.	.30 - .33	.30 - .33	.35 - .38
Dinitrotoluen, bbl	lb.	.15 - .17	.16 - .17	.18 - .20
Dip oil, 25% dr	gal.	.28 - .30	.28 - .30	.26 - .28
Diphenylamine, bbl	lb.	.48 - .50	.48 - .50	.48 - .50
H-acid, bbl	lb.	.68 - .72	.72 - .73	.70 - .74

Coal-Tar Products—Continued

		Current Price	Last Month	Last Year
Naphthalene, flake, bbl	lb.	$0.06 -$0.06½	$0.05 -$0.05¼	$0.05 -$0.05¼
Nitrobenzene, dr	lb.	.09½- .10	.09½- .10	.09 - .10
Para-nitraniline, bbl	lb.	.53 - .54	.59 - .61	.65 - .67
Para-nitrotoluine, bbl	lb.	.35 - .36	.35 - .36	.40 - .42
Phenol, U.S.P., drums	lb.	.22 - .24	.22 - .24	.23 - .25
Picric acid, bbl	lb.	.25 - .26	.25 - .26	.20 - .22
Pyridine, dr	lb.	4.15 - 4.25	4.30 - 4.35	4.10 - 4.20
R-salt, bbl	lb.	.40 - .44	.40 - .44	.50 - .55
Resorcinal, tech, kegs	lb.	1.30 - 1.35	1.35 - 1.40	1.30 - 1.40
Salicylic acid, tech., bbl	lb.	.33 - .34	.33 - .34	.32 - .33
Solvent naphtha, w.w.,tanks	gal.	.35 -......	.26 -......	.24 - .25
Tolidine, bbl	lb.	.90 - .95	.95 - .96	1.00- 1.05
Toluene, tanks, works	gal.	.35 -......	.26 -......	.26 -......
Xylene, com., tanks	gal.	.31 - .36	.26 - .27	.24 - .26

Miscellaneous

		Current Price	Last Month	Last Year
Barytes, grd., white, bbl	ton	$22.00-$24.00	$17.00-$17.50	$17.00-$17.50
Casein, tech., bbl	lb.	.13½- .14	.13 - .13½	.10½- .11
China clay, powd., f.o.b. Ga.	ton	10.00 -20.00	12.00 -15.00	12.00 -15.00
Imported, powd.	ton	45.00 -50.00	45.00 -50.00	45.00 -50.00
Dry colors:				
Carbon gas, black (wks.)	lb.	.08 - .08½	.07 - .07½	.08 - .09
Prussian blue, bbl	lb.	.34 - .36	.34 - .36	.35 - .37
Ultramine blue, bbl	lb.	.08 - .35	.08 - .35	.08 - .35
Chrome green, bbl	lb.	.28 - .30	.28 - .30	.30 - .32
Carmine red, tins	lb.	5.00 - 5.10	4.90 - 5.00	4.25 - 4.50
Para toner	lb.	.90 - .95	.90 - .95	.95 - 1.00
Vermilion, English, bbl	lb.	1.45 - 1.50	1.40 - 1.45	1.45 - 1.50
Chrome yellow, C. P., bbl.	lb.	.18 - .18¾	.18 - .18½	.20 - .22
Feldspar, No. 1 (f.o.b. N. C.)	ton	6.00 - 6.50	5.50 - 6.00	6.50 - 7.00
Graphite, Ceylon, lump, bbl	lb.	.08½- .09	.08½- .09	.07 - .07½
Gum copal, Congo, bags	lb.	.09¾- .10	.08½- .10	.08 - .10
Manila, bags	lb.	.14 - .16	.14 - .16	.14 - .16
Damar, Batavia, cases	lb.	.29½- .30	.25 - .26	.28½- .28¾
Kauri, No. 1 cases	lb.	.57 - .65	.60 - .65	.58 - .62
Kieselguhr (f.o.b. N. Y.)	ton	50.00 -55.00	50.00 -55.00	50.00 -55.00
Magnesite, calc.	ton	40.00 -41.00	35.00 -42.00	35.00 -40.00
Pumice stone, lump, bbl.	lb.	.04½- .06	.04½- .08	.05 - .05½
Imported, casks	lb.	.03 - .40	.03 - .40	.03 - .35
Rosin, B-H.	bbl.	14.65 -15.75	14.50 -......	8.15 - 8.25
Turpentine	gal.	1.10½-......	1.11 -......	.92 -......
Shellac, orange, fine, bags	lb.	.73 - .75	.72 - .74	.65 - .66
Bleached, bonedry, bags	lb.	.55 - .57	.59 - .62	.73 - .74
T. N. bags	lb.	.45 - .47	.49 - .51	.62 - .63
Soapstone (f.o.b. Vt.), bags	ton	9.00 -10.00	7.00 - 7.50	7.50 - 8.00
Talc, 200 mesh (f.o.b. Vt.)	ton	11.00 -......	11.00 -......	10.50 -......
200 mesh (f.o.b. Ga.)	ton	7.50 -10.00	7.50 -10.00	8.00 -12.00
325 mesh (f.o.b. N. Y.)	ton	14.75 -......	14.75 -......	14.75 -.....1
Wax, Bayberry, bbl	lb.	.20 - .21	.20 - .22	.21 - .21½
Beeswax, ref., light	lb.	.44 - .45	.43 - .44	.38 - .39
Candelilla, bags	lb.	.32 - .33	.30 - .31	.32 - .33
Carnauba, No. 1, bags	lb.	.50 - .51	.43 - .44	.37 - .38
Parafine, crude 105-110 m.p.	lb.	.05½- .06	.06 - .06¼	.06¼-......

Ferro-Alloys

		Current Price	Last Month	Last Year
Ferrotitanium, 15-18%	ton	$200.00-.....	$200.00-.....	$200.00-.....
Ferrochromium, 1-2%	lb.	.23- .35	.23- .35	.30-.....
Ferromanganese, 78-82%	ton	115.00-.....	115.00-.....	105.00-.....
Spiegeleisen, 19-21%	ton	33.00-34.00	32.00-33.00	32.00-.....
Ferrosilicon, 10-12%	ton	33.00-38.00	33.00-38.00	39.50-43.00
Ferrotungsten, 70-80%	lb.	1.14- 1.20	1.15-.....	.85- .90
Ferro-uranium, 35-50%	lb.	4.50-.....	4.50-.....	4.50-.....
Ferrovanadium, 30-40%	lb.	3.25- 4.00	3.25- 4.00	3.25- 3.75

Non-Ferrous Metals

		Current Price	Last Month	Last Year
Copper, electrolytic	lb.	$0.14 -$0.14½	$0.14½-$0.14¾	$0.14¾-$0.15½
Aluminum, 96-99%	lb.	.28 - .29	.28 -......	.27 - .28
Antimony, Chin. and Jap.	lb.	.20½- .21	.20 - .20½	.17¾-......
Nickel, 99%	lb.	.34 -......	.34 -	.31 - .32
Monel metal, blocks	lb.	.32 - .33	.32 - .33	.32 - .33
Tin, 5-ton lots, Straits	lb.	.63½-......	.62½-......	.58¾-......
Lead, New York, spot	lb.	.09¾-......	.09¾-......	.10½-......
Zinc, New York, spot	lb.	.09¼-......	.09¼-......	.08¼-......
Silver, commercial	oz.	.69½-......	.70½-......	.68½-......
Cadmium	lb.	.60 -......	.60 -......	.60 -......
Bismuth, 508-lb. lots	lb.	2.65 - 2.70	2.65 - 2.70	1.25 - 1.50
Cobalt	lb.	2.50 -......	2.50 -......	2.50 - 3.00
Magnesium, ingots, 99%	lb.	1.00 -......	1.00 -......	.90 - .95
Platinum, ref	oz.	120.00-......	120.00-......	117.00-......
Palladium, ref.	oz.	78.00- 83.00	78.00- 83.00	78.00-......
Mercury, flask 75	lb.	91.00-......	88.00-......	81.00-83.00
Tungsten powder	lb.	1.20-......	1.20-......	.95- 1.00

Ores and Semi-finished Products

		Current Price	Last Month	Last Year
Bauxite, crushed, wks.	ton	$5.50- $8.50	$5.50- $8.50	$5.50- $8.75
Chrome ore, c.f. post	ton	20.50- 23.50	20.50- 23.50	18.50- 24.00
Coke, fdry., f.o.b. ovens	ton	3.75- 4.25	3.75- 4.25	5.00- 5.50
Fluorspar, gravel, f.o.b. Ill.	ton	16.00- 18.00	16.00- 18.00	17.50- 18.50
Ilmenite, 52% TiO_2, Va.	lb.	.01½-......	.01½-......	.01½-......
Manganese ore, 50% Mn., c.i.f. Atlantic Ports	unit	.42 - .44	.42 - .44	.39 - .41
Molybdemite, 85% MoS_2 per lb. MoS_2, N. Y.	lb.	.65 - .70	.65 - .70	.65- .70
Monazite, 6% of ThO_2	ton	120.00-......	120.00-......	120.00-......
Pyrites, Span. fines, c.i.f.	unit	.12½-......	.12½-......	.11½- .12
Rutile, 94-96% TiO_2	lb.	.12 - .15	.12 - .15	.12 - .15
Tungsten, scheelite, 60% WO_3 and over	unit	12.50 -13.00	12.50 -13.00	9.50 - 9.75
Vanadium ore, per lb. V_2O_5	lb.	1.00 - 1.25	1.00 - 1.05	1.00 - 1.25
Zircon, 99%	lb.	.03 -......	.03 -......	.06 - .0

Patents Issued Dec. 8 to Dec. 29, 1925

Paper, Pulp and Sugar

Paper Drier and the Like. Homer D. Martindale, Middletown, Ohio.—1,567,377.

Activating Decolorizing Char for Use in Refining Sugar and for Analogous Purposes. Charles B. Davis, New York, N. Y.—1,565,911.

Process of Chlorination of Sulphite Liquor. Albert Schmidt, Paris, France.—1,567,395.

Process for Producing Pulp. William D. Gregor, Wesley M. Osborne, and Alex J. Kemzura, Newton Falls, N. Y.—1,565,090.

Paper-Making Machine. Harry G. Van Ornum, Newton Falls, N. Y.—1,564,728.

Rubber and Synthetic Plastics

Apparatus for Treating Rubber and the Like. Frank Garner, Chapel-en-le-Frith and Alfred Hall, Ansdell, England.—1,567,587.

Process for the Vulcanization of Caoutchouc. Hermann Oehme, Kalk, near Cologne, Germany, assignor to Chemische Fabrik Kalk Ges. mit beschränkter Haftung, Cologne-on-the-Rhine, Germany.—1,565,812.

Process for the Production of Combinations of Rubber and Paper and Products Obtained Thereby. Ernest Hopkinson, New York, and Reed P. Rose, Jackson Heights, N. Y., assignors to General Rubber Company, New York, N. Y.—1,567,646.

Process for Vulcanizing Rubber and Products Obtained Thereby. Sidney M. Cadwell, Leonia, N. J., assignor to The Naugatuck Chemical Company.—1,564,824.

Process of Vulcanizing of Caoutchouc. James M. Gillett, Milwaukee, Wis., assignor to The Goodyear Tire and Rubber Company, Akron, Ohio.—1,566,247.

Rubber Cement. Benjamin P. Taylor, Wyoming, Ohio, assignor to Taylorall, Inc., Cincinnati, Ohio.—1,566,566.

Method of Uniformly and Intimately Mixing Materials with Rubber Latex. Ernest Hopkinson, New York, N. Y.—1,567,506.

Production of Phenol-Methylal Resin. Carnie B. Carter and Albert E. Coxe, Pittsburgh, Pa., assignors to S. Karpen & Bros., Chicago, Ill.—1,566,817.

Process of Producing a Phenolic Condensation Product. Carnie B. Carter, Pittsburgh, Pa., assignor to S. Karpen & Bros., Chicago, Ill.—1,566,823.

Petroleum Refining

Treatment of Hydrocarbons. Charles N. Forrest, Rahway, and Harold P. Hayden, Perth Amboy, N. J., assignors to The Barber Asphalt Company, Philadelphia, Pa.—1,568,018.

Apparatus for Treating Hydrocarbons. Fred G. Niece, Cleveland, Ohio, assignor to The International Holding Company, Cleveland, Ohio.—1,566,416.

Apparatus for Refining Petroleum. William H. Stilson, New York, N. Y., assignor to Stilson Process Corporation, Dover, Del.—1,564,984.

Art of Cracking Hydrocarbons. Fred G. Niece, Cleveland, Ohio, assignor to the International Holding Company, Cleveland, Ohio.—1,565,326.

Process for Series Separation of Crude Petroleum. Alfred R. Earl and Thomas W. Reeves, Toledo, Ohio.—1,567,429.

Recovery of Gasoline from Natural Gas. Homer A. Mossor, Stoffel, W. Va., assignor to South Penn Oil Company, Pittsburgh, Pa.—1,565,749.

Process of Manufacturing Lubricating Oils. Richard W. Hanna, Piedmont, and Orville Ellsworth Cushman and Theodore William Doell, Berkeley, Calif., assignors to Standard Oil Company, San Francisco, Calif.—1,566,000.

Method of Manufacturing Lubricating Oils. James W. Weir, Fillmore, Calif., assignor of one-half to John C. Black, Destrehan, La.—1,564,501.

Process of Converting Hydrocarbon Oils. Joseph H. Adams, Brooklyn, N. Y.—1,568,016.

Apparatus for Treating Hydrocarbons. Frank C. Vande Water and Frederick R. Sunderman, Newburgh, N. Y., assignors to Petroleum Laboratories, Inc., Newburgh, N. Y.—1,567,212.

Art of Preventing Loss by Evaporation from Storage Tanks. Robert E. Wilson, Chicago, Ill., assignor to Standard Oil Company, Whiting, Ind.—1,566,944.

Method of Preventing Evaporation from Storage Tanks. Gentry Cash, Whiting, Ind., assignor to Standard Oil Company, Chicago, Ill., and Whiting, Ind.—1,566,825.

Apparatus for Separating and Extracting Mineral Oils from Oily Sand, Bitumen from Oily Chalk, Oily Slate, Coal, Etc. Heinrich Preller, Berlin-Friedenau, Germany.—1,567,983.

Oil-Shale Retort. John T. Pope, Salt Lake City, Utah.—1,564,271.

Process for Oxidizing Oils. Alfred Eisenstein, Leitmeritz, Czechoslovakia, assignor of one-half to the firm Georg Schicht, A.-G., Aussig, Czechoslovakia.—1,564,331.

Fabric Impervious to Petroleum Hydrocarbon Vapors. Robert E. Wilson, Chicago, Ill., and Eugene P. Brown, Whiting, Ind., assignors to Standard Oil Company, Whiting, Ind.—1,566,943.

Combustion and Fuels

Process of Gasifying and Carbonizing Coal and Like Fuel Substances. Henri Macaux, Paris, France, assignor to Societe Lyonnaise des Eaux et de l'Eclairage, Paris, France.—1,567,967.

Process and Apparatus for Producing Compressed Peat. John S. Burt, Walpole, Mass., assignor, by mesne assignments, to Field Security Company, Boston, Mass.—1,567,489.

Refractory Cement with a Base of

Zirconium Ore. Frédéric Charles Fridtjof le Coultre, Marseille, France, assignor to "Societe d'Etude des Agglomérés," Paris, France.—1,565,472.

Fuel Drier. Henry Kreisinger, Piermont, N. Y., assignor to Combustion Engineering Corporation, New York, N. Y.—1,564,361.

Inorganic Processes

Apparatus for Making Anhydrous Metallic Chlorides. Frederick T. Wohlers, Hasbrouck Heights, N. J., assignor to The Anhydrous Metallic Chlorides Corporation, Dover, Del.—1,564,302.

Process for Obtaining Alkali-Metal Thiosulphate from Solutions Containing Alkali-Metal Sulphide. Friedrich Rüsberg, Mannheim, Germany, assignor to the Firm Rhenania Verein Chemischer Fabriken A. G., Cologne, Germany.—1,567,755.

Process of Making Aluminum Sulphate from Aluminous Materials. Richard Moldenke, Watchung, N. J., and Wilhelm Schumacher, Berlin, Germany; said Schumacher assignor to said Moldenke.—1,567,-610.

Method of Making Anhydrous Magnesium Chloride. Paul Cottringer and William R. Collings, Midland, Mich., assignors to The Dow Chemical Company, Midland, Mich.—1,567,317.

Production of Aluminum Chloride. Louis Burgess, Bayonne, N. J., assignor, by mesne assignments, to himself and Maurice Barnett.—1,566,269.

Method for Manufacturing Gypsum from Anhydrite. Marie Farnsworth, New Brunswick, N. J.—1,566,186.

Method of Hydrating Lime. John P. Rich, Swanton, Vt.—1,565,107.

Process of Slaking Lime Into Lime Putty. David A. Evans, Kansas City, Mo., assignor, by mesne, assignments, of fifty-one one-hundreths to The Evans Lime Putty Company, Kansas City, Kans.—1,566,587.

Treatment of Cementitious Material. Kaspar Winkler, Altstetten, Switzerland.—1,565,839.

Process for Making Waterproof Portland Cement. Charles N. Miller, San Francisco, Calif.—1,566,498.

Refractory Material, Articles Made Therefrom, and Method of Making the Same. Simon J. Lubowsky, Jersey City, N. J., assignor to Metal & Thermit Corporation, Chrome, N. J.—1,567,445.

Process of Treating Fertilizers. Peter Tomy Axelsen, Rjukan, Norway, assignor to Norsk Hydro-Elektrisk Kvaelstofaktieselskab, Christiania, Norway.—1,567,408.

Electrode for Use in the Contact Process of Making Sulphuric Acid. Franz Vorländer and Hermann Weber, Wolfen, Kreis Bitterfeld, Germany, assignors to Actien Gesellschaft für Anilin Fabrikation, Berlin, Germany.—1,565,691.

Manufacturing Solid Calcium Nitrate. Carl Eyer and Robert Griessbach, Ludwigshafen-on-the-Rhine, Germany, assignors to Badische Anilin-&-Soda-Fabrik, Ludwigshafen-on-the-Rhine, Germany.—1,564,410.

Process for Reducing Sulphates and the Like. Alfred H. White, Ann Arbor, Mich., assignor to John E. Alexander, Port Edwards, Wis., and E. G. Goodell, trustees, Stevens Point, Wis.—1,565,300.

Porous Mass and Process of Preparing the Same. Arthur B. Ray, Flushing, N. Y., assignor to Carbide and Carbon Chemicals Corporation.—1,565,328.

Method of Coating with Metals and Resulting Products. Arthur Z. Pedersen, West Orange, N. J., assignor, by mesne assignments, to Madsenell Corporation, New York, N. Y.—1,564,710.

Process of Calcining Material. Albert S. Walden, Cleveland, Ohio, assignor to National Carbon Company, Inc.—1,564,730.

Method of Making Porcelain Articles. Edward L. Dillman, Jamaica, N. Y.—1,566,-841.

Method of Manufacturing Hydrogen Sulphide Gas. Emile Bindschedler, Lansdowne, Pa., and Edward W. Rugeley, Hopewell, Va., assignors of their entire right to Tubize Artificial Silk Company of America.—1,565,894.

Organic Processes

Bluish Sulphurized Indophenol-Benzidine Dye and Process of Making the Same. Louis Haas, Paris, France, and Emil Reber, Basel, Switzerland, assignors to Society of Chemical Industry in Basle, Basel, Switzerland.—1,565,736.

Manufacture of 2-Amino Anthraquinone. Orin D. Cunningham, Buffalo, N. Y., assignor to National Aniline & Chemical Company, Inc., New York, N. Y.—1,564,210.

Indigoid Dyestuff of the Anthraquinone Series and Intermediate Products and Process of Making Same. Bertram Mayer and Wilhelm Moser, Basel, Switzerland, assignors to Society of Chemical Industry in Basle, Basel, Switzerland.—1,567,158.

Brown Trisazo Dyestuffs and Process of Making Same. Bartholomäus Vossen, of Hochst-on-the-Main, Germany, assignor, by mesne assignments, to Grasselli Dyestuff Corporation, New York, N. Y.—1,565,344.

Manufacture of Benzanthrone Derivatives. Arthur Lüttringhaus and Hugo Wolff, Mannheim, and Heinrich Neresheimer, Ludwigshafen-on-the-Rhine, Germany, assignors to Badische Anilin-& Soda-Fabrik, Ludwigshafen-on-the-Rhine, Germany.—1,564,423.

Process for the Production of Benzanthrone Derivatives. Georg Kalischer, Mainkur, near Frankfort-on-the-Main, and Rudolf Müller and Fritz Frister, Fechenheim, near Frankfort-on-the-Main, Germany, assignors to Leopold Cassella & Co. Gesellschaft mit beschränkter Haftung.—1,565,229.

Manufacture of Derivatives of 4-Hydroxypiperidines and Process of Making Same. Hermann Staudinger, Zurich, Switzerland, assignor to Society of Chemical Industry in Basel, Basel, Switzerland.—1,567,200.

Condensation Product of the Anthraquinone Series and Process of Making Same. Georg Kränzlein, Martin Corell, and Robert Sedlmayr, Hochst-on-the-Main, Germany, assignors, by mesne assignments, to Grasselli Dyestuff Corporation, New York, N. Y.—1,564,584.

4-Nitro-1-Acetnaphthalid-6 (Or 7)-Mono-Sulphonic Acid. Walter M. Ralph, Buffalo, N. Y., assignor to National Aniline & Chemical Company, Inc., New York, N. Y.—1,566,425.

Process of Making Thin Boiling Starch. John R. MacMillan, La Salle, N. Y., assignor to Niagara Alkali Company, Niagara Falls, N. Y.—1,567,609.

Process for the Manufacture of Soluble-Starch Products. Robert Haller, Grossenhain, Germany, assignor to Chemische Fabrik Pyrgos, Radebeul-Dresden, Germany.—1,564,955.

Process of Manufacturing Starch Products. Philip A. Singer, Milwaukee, Wis.—1,564,979.

Manufacture of Alcohols. Carnie B. Carter and Albert E. Coxe, Pittsburgh, Pa., assignors to S. Karpen & Bros., Chicago, Ill.—1,566,818.

Process of Producing Methyl Alcohol and Methylene Chloride from Methane. Josef Weber, Essen, and Paul Erasmus, Berlin-Wilmersdorf, Germany, assignors to the firm Th. Goldschmidt A.-G., Essen, Germany.—1,565,345.

Manufacture of Normal Butyl Alcohol. Firmin Boinot, Melle, France, assignor to Commercial Solvents Corporation, Baltimore, Md.—1,565,543.

Production of M-Amino-P-Cresol-Methyl-Ether. Clarence G. Derick, Thomas H. Leaming, and Walter M. Ralph, Buffalo, N. Y., assignors to National Aniline & Chemical Co., Inc., New York, N. Y.—1,564,214.

Production and Isolation of Alkali Salts of Aromatic Sulphonic Acids. Homer W. Hillyer, Farmington, Conn., assignor to National Aniline & Chemical Company, Inc., New York, N. Y.—1,564,239.

Process of Making Derivatives of Hypothetical Imines Including Amines and Their Substitution Products. Karl Friedrich Schmidt, Heidelberg, Germany.—1,564,631.

Manufacture of Formamide. Rudolf Wietzel, Ludwigshafen-on-the-Rhine, Germany, assignor to Badische Anilin- & Soda-Fabrik, Ludwigshafen-on-the-Rhine, Germany.—1,567,312.

Recovery of Phenols from Ammoniacal Liquor. Le Roy Wilbur Heffner, East Norristown Township, Montgomery County, and William Tiddy, Jeffersonville, Pa.—1,566,796.

Process for Recovering the Lye from Disintegrated Celluloses. Gustav Mosebach, Nordhausen, Germany.—1,567,668.

Method of Reducing the Vicosity Characteristics of Nitrocellulose. Neil S. Kocher, and Victor E. Kimmel, Rochester, N. Y., assignors to Eastman Kodak Company, Rochester, N. Y.—1,564,689.

Process of Manufacture of Cellulose Esters or Ethers in a Solvent. Nicolas Benoit Grillet, Neuilly, France, assignor to Societe Chimique des Usines du Rhone, Paris, France.—1,566,398.

Process of Removing Pyridine from Nitrocellulosic Materials. Leon W. Eberlin, Rochester, N. Y., assignor to Eastman Kodak Company, Rochester, N. Y.—1,564,-765.

Manufacture of Artificial Silk and the Like from Cellulose Derivatives. Henry Dreyfus, London, England.—1,566,384.

Explosive. Nils Alfred Unger, Vinterviken, Aspudden, Sweden.—1,566,784.

Process of Preparing Propellant Powders. Charles R. Franklin, Dover, N. J.—1,564,-549.

Manufacture of Neo-Arsphenamine. Philip A. Kober, Hastings-upon-Hudson, N. Y.—1,564,859.

Vulcanizing Fat Substances. Johannes Hendrik van der Meulen, Arnhem, Netherlands.—1,566,785.

Process of Producing A Binding and Waterproofing Bituminous Soap for Binding and Waterproofing Paving and Building Materials. Leonard Schade van Westrum, New York, N. Y.—1,565,125.

Process for the Acetylenation of Fatty and Other Substances. Louis G. Bourgoin, Montreal, Quebec, Canada.—1,567,785.

Process of Manufacturing Hydro-Carbons and Cyanides. John Collins Clancy, Asbury Park, N. J.—1,567,241.

Process and Apparatus for Treating Vegetable Substances. Charles R. Mabee, Buffalo, N. Y., assignor to Mabee Patents Corporation.—1,565,282.

Tanning of Skins and Hides. Johannes Hell, Esslingen, Germany.—1,567,644.

Electrolytic Cells and Processes

Electroplating. Willis R. King, Newark, N. J., assignor to The Hanson & Van Winkle Company, Newark, N. J.—1,564,581.

Cadmium Plating. Clayton M. Hoff, Cleveland, Ohio, assignor to The Grasselli Chemical Company, Cleveland, Ohio.—1,564,414.

Electroplating Method and Electroplated Articles. Robert Jay Shoemaker, Chicago, Ill.—1,566,984.

Electrolytic Cell. Albert Edgar Knowles, Heswall, England.—1,566,543.

Electrolytic-Cell Battery. William E. Mortrude, Jr., Seattle, Wash., assignor of one-fourth to Charles W. Littlefield, one-fourth to Philip T. Molleur, and one-fourth to Dan C. Brownell, all of Seattle, Wash.—1,566,804.

Electrolytic Cell. Martin W. Cowles, Fairfield, Conn.—1,564,406.

Voltaic Cell. Miller Eugene Conrad, Atlantic, Iowa, assignor to C. B. Schoenmehl Incorporated, Waterbury, Conn.—1,567,838.

Process for the Electrolysis of Alkali Chlorides. Heinrich Klopstock, Aussig, Czechoslovakia.—1,565,943.

Dry Cell. Victor Yngve, South Orange, N. J., assignor to Manhattan Electrical Supply Company, Inc., New York, N. Y.—1,567,561.

Manufacture of Dry Cells. Harold de Olaneta, New Haven, Conn., assignor to Winchester Repeating Arms Company, New Haven, Conn.—1,564,951.

Dry Battery. David Rosen, New York, N. Y.; Bessie Rosen, administratrix of said David Rosen, deceased.—1,566,927.

Chemical Engineering Equipment

Dehydration Process. Harold C. Eddy, Los Angeles, Calif., assignor to Petroleum Rectifying Company of California.—1,565,-992.

Drier. Emil J. Carroll, Cincinnati, Ohio, assignor to The American Laundry Machinery Company, Cincinnati, Ohio.—1,567,-709.

Drier. Elwood B. Ayres, Melrose Park, and Alpheus O. Hurxthal, Philadelphia, Pa., assignors to Proctor & Schwartz, Incorporated, Philadelphia, Pa.—1,567,891.

Continuous Drying Kiln and Method of Drying Ware. Thure Larsson, Worcester, Mass., assignor to Norton Company, Worcester, Mass.—1,567,023.

Rotary Drying Apparatus. Paul Scrive, Paris, France.—1,567,335.

Drying Plant. Pilade Barducci, Milan, Italy.—1,566,244.

Method of Drying and Oxidizing Materials in Suspended Condition. Gordon Don Harris, Islip, N. Y., assignor, by mesne assignments, to The Industrial Dryer Corporation, Stamford, Conn.—1,564,565.

Method and Means for Drying Textile Material. William G. R. Braemer, Haddonfield, N. J., and Joseph Roberts, Providence, R. I., assignors to General Fire Extinguisher Company.—1,566,644.

Method of and Apparatus for Drying Including Solvent Recovery. Gordon Don Harris, Islip, N. Y., assignor, by mesne assignments, to The Industrial Dryer Corporation, Stamford, Conn.—1,564,783.

Apparatus for Drying Sheet Material. Ian D. Patterson, Akron, Ohio, assignor to The Goodyear Tire & Rubber Company, Akron, Ohio.—1,565,494.

Filter. William P. Cottrell, Los Angeles, Calif.—1,565,988.

Absorption Tower. Daniel L. Newton, Fullerton, Calif.—1,567,456.

Pulverizing Mill. Christian M. Lauritzen, Chicago, and William H. Vogel, Highland Park, Ill., assignors to Raymond Brothers Impact Pulverizer Co., Chicago, Ill.—1,566,-546.

Current Industrial Developments

New Construction and Machinery Requirements

New England

Conn., New Britain—The Stanley Works awarded contract for the design and construction of a 110 x 250 ft. building to be used for gauging rolls and annealing furnaces and a 46 x 82 ft. addition to machine shop to M. C. Tuttle Co., 862 Park Square Bldg., Boston, Mass.

Mass., Cambridge (Boston P. O.)—Cambridge Rubber Co., 748 Main St., is recieving bids for the construction of a 2 story, 45 x 90 ft. addition to factory. Estimated cost $40,000. J. R. Worcester Co., 79 Milk St., Boston, is engineer.

Middle Atlantic

Md., College Park—University of Maryland awarded contract for the construction of a 3 story, 74 x 112 ft. chemistry building, etc., to Consolidated Engineering Co., 20 East Franklin St., Baltimore. Estimated cost $150,000.

N. J., Jersey City—Brady Brass Co., 14th and Henderson Sts., awarded contract for the construction of a 2 story addition to plant on 14th St. to J. Jewkes & Son, 676 Montgomery St. Estimated cost $55,000.

N. J., Lambertville—New Jersey Rubber Co., C. M. Dilts, Supt., plans the installation of two new refiners, three batching mills and 1 grinder to be operated by a 400 hp. motor. Engineer not selected.

N. J., Paulsboro—Vacuum Oil Co. plans the construction of a 3 story, 80 x 52 ft. compounding plant. Private plans.

N. J., Trenton — Trenton Potteries Co., North Clinton and Ott Sts., plans the construction of a kiln building, dipping factory, tunnel and shop with laboratory for research work. W. A. Klemann, First National Bank Bldg., Archt. Also awarded contract for a 4 story, 50 x 94 ft. plant on Labor St., to J. H. Morris Co., 211 North Montgomery Sts. Estimated cost $75,000 and $54,000 respectively.

N. Y., Akron—Louisville Cement Co. is in the market for machinery and equipment for the manufacture of water lime cement.

N. Y., Brooklyn — American Sugar Refining Co., 117 Wall St., New York, plans the construction of a warehouse and refinery at Kent Ave. between Grand and South 5th Sts., here. Estimated cost $500,000. C. Huttlingler, 117 Wall St., is architect and engineer.

N. Y., Port Ivory (mail Mariners Harbor)—Proctor & Gamble, 6th and Main Sts., Cincinnati, O., will soon receive bids for the construction of addition to factory, here. Estimated cost $3,000,000. H. Manly, 20 East 53rd St., New York, N. Y., is consulting engineer. Also awarded contract for the design and construction of 2 additional buildings with furnace and generator buildings for hydrogen gas equipment to H. K. Ferguson Co., 4900 Euclid Avenue Bldg., Cleveland, O. Estimated cost $150,000.

Pa., Beaver Falls — Mayer China Co. awarded contract for the construction of a 2 story, 44 x 140 ft. addition to factory to Cook Anderson Co. Estimated cost $50,000.

Pa., Mill Hall—Harrison-Walker Brick Co., Mount Union, plans the construction of a brick manufacturing plant including power plant, crushers, bins, clay trestles, etc. here. Estimated cost $150,000.

Pa., Oaks—Philadelphia Rubber Works Co., Land Title Bldg., Philadelphia, awarded contract for the construction of new buildings for plant to Wm. Steele & Son Co., 219 North Broad St., Philadelphia. Estimated cost $400,000.

Pa., Williamsburg — The West Virginia Pulp & Paper Co., 200 5th Ave., New York, N. Y., awarded contract for the construction of a 2 story, 80 x 170 ft. addition to plant to M. C. Tuttle Co., Park Square Bldg., Boston, Mass.

South

Ala., St. Stephens—Santa Rosa Portland Cement Co., c/o C. Hall, Pres., Nashville, Tenn., awarded contract for the construction of a 6,000 bbl. per day capacity cement plant here, to H. K. Ferguson Co., 4900 Euclid Ave., Cleveland, O. Estimated cost $2,500,000.

Fla., Ocala—Ocala Portland Cement Co., Hunt Bldg., has acquired a 390 acre site and plans the construction of a cement plant, 1,000,000 bbls. annual capacity, in Marion county. Estimated cost $2,500,000. F. L. Smidth & Co., 50 Church St., New York, N. Y., are engineers.

Ga., Atlanta—J. M. Tull Rubber Co., 150 Marretta Bldg., plans the construction of a plant for manufacture of rubber products. Estimated cost $250,000.

Ky., Louisville—U. S. Engineer's Office, P. O. Box 72, will receive bids until Jan. 22 for furnishing and delivering approximately 1,180 tons of hydrated lime.

La., Morgan City—The Dixie Pulp & Paper Co., E. G. Simmons, Dir., Union Indemnity Bldg., New Orleans, recently incorporated plan the construction of a paper mill.

Tenn., Johnson City — American Bemberg Corp. awarded contract for the construction of an artificial silk plant including manufacturing buildings, power house, pump house, supply house, water system, etc., to Hughes-Foulkrod Co., Commonwealth Bldg., Philadelphia, Pa. Estimated cost $1,250,000.

Tenn., Nashville—Dept. of Waterworks appropriated $31,600 for the purchase of chemicals for water purification in 1926.

W. Va., Huntington—International Nickel Co., Guyan River Road, awarded contract for the construction of a 65 x 275 ft. addition to plant to H. K. Ferguson Co., 4900 Euclid Ave., Cleveland, O.

Middle West

Ill., Chicago—Wadsworth Howland Co., 225 North Carpenter St., awarded contract for the construction of a 6 story, 111 x 163 ft. paint factory at North Western Ave. and Pan Handle R.R. to H. F. Friedstedt & Co., 431 North Michigan Ave. Estimated cost $150,000.

Ind., Hartford City—Hartford City Paper Co. awarded contract for the construction of a 2 story, 40 x 44 ft. paper factory to Indiana Engineering & Construction Co., Central Bldg., Ft. Wayne. Estimated cost $50,000.

Ind., Terre Haute—Terre Haute Paper Co., 19th St. and Van R.R., plans the construction of a 3 story, 45 x 100 ft. paper mill. Estimated cost $65,000. Private plans.

Mich., Detroit—Michigan Copper & Brass Co., 5851 West Jefferson Ave., manufacturers of copper, brass and aluminum sheets, awarded contract for the construction of an aluminum smelting building to The Austin Co., 1954 Penobscot Bldg., Cleveland, O.

Mich., Watervliet—The Watervliet Paper Co. plans to expend $500,000 for equipment including the installation of a 100 in. trim paper making machine to double the capacity of its plant, 2 new 100 in double coating machines, etc.

O., Akron—The Goodyear Tire & Rubber Co. awarded contract for the construction of two 1 story, 60 x 100 and 100 x 120 ft. factory buildings to Hunkin-Conkey Construction Co., Hunkin-Conkey Bldg. Estimated cost $100,000.

O., Alliance — Stewart Bros. Paint Co., 204 South Seneca Ave., awarded contract for the construction of a 2 story factory on North Union Ave., to A. F. Wendling Co., Massillon. Estimated cost $50,000.

O., Chillicothe—Fairfield Paper Co., Baltimore, Ohio, T. D. Griley, Pres., awarded contract for the construction of a factory to make corrugated paper to H. K. Ferguson Construction Co., 6300 Euclid Ave., Cleveland. $200,000.

O., Cleveland—The Acme Artificial Silk Co., 1294 West 70th St., had plans prepared for the construction of a 1 story, 31 x 110 ft. addition to factory. Estimated cost $40,000. J. L. Collins, 7016 Euclid Ave., is architect.

O., Cleveland—Aluminum Co. of America, C. O. Tessier, Plant Mgr., 2610 Harvard Ave., awarded steel contract for a 1 story, 50 x 300 ft. addition to foundry to McClintic-Marshall Co., Oliver Bldg., Pittsburgh, Pa. Estimated cost $100,000.

O., Cleveland—The Cleveland Cap Screw Co., J. W. Fribley, Pres., 2921 East 79th St., plans the construction of a 3 story, 70 x 90 ft. heat treating plant and chemical laboratory. Estimated cost $95,000. Private plans.

O., Cleveland — The Vitrolite Co., C. A. Myers, Pres., 2907 Detroit Ave., awarded contract for the construction of a 2 story, 44 x 147 ft. factory and warehouse for the manufacture of tiles to Mitzel-Shields Co., Rose Bldg. Estimated cost $60,000.

O., Kenmore — The Miller Rubber Co., South High St., Akron, awarded contract for the design and construction of a reclaiming plant here, 35,000 sq.ft. floor space to the Austin Co., 16112 Euclid Ave., Cleveland.

O., Wooster—Coxon-Beleek Illuminating Co., H. B. Coxon, Mgr., is in the market for clay mixing machinery.

Wis., Combined Locks—Combined Locks Paper Co. awarded contract for the construction of a 2 story, 102 x 170 ft. addition to paper mill to C. R. Meyer & Son, 50 State St., Oshkosh.

Wis., Kenosha—Specialty Brass Co., 917 Lester St., awarded contract for remodeling of foundry on Sheridan Road to J. Jensen, West Prairie Ave. Estimated cost $40,000. Equipment including 10 or 12 coke furnaces for melting brass and moulding machines will be installed.

Wis., Kohler—Kohler Co., manufacturers of plumbing fixtures, awarded contract for the construction of a 1 story, 72 x 228 ft. enameling shop to F. Radloff Co., Plymouth.

West of Missisippi

Kan., Winfield — J. A. Hull, Kennedy Bldg., Tulsa, Okla., plans the construction of an absorption natural gasoline plant, near here. W. A. Melton in charge of gasoline department.

Mo., Joplin—Bunker Hill & Sullivan Co. plans the construction of an electrolytic zinc plant. Estimated cost $1,000,000.

N. M., Artesia—Phillips Petroleum Co., Bartlesville, Okla., plans the construction of a 9,000 gal. casing head plant in Artesia Fields here. Estimated cost $625,000. Private plans. Work will probably be done by day labor.

Okla., Papoose City—Amerada Petroleum Corp. has work under way on the construction of a 3 unit low pressure absorption gasoline plant, 15,000 gals. daily capacity.

Okla., Tulsa—Ora Products Rubber Co., 1318 Greeley Ave., Kansas City, Mo., is in the market for rubber mills and hydraulic presses, 42 x 44 and larger for proposed plant for the manufacture of rubber tile and flooring here.

Okla., Tulsa—Ozark Chemical Co., is installing additional equipment to increase the capacity of its plant to 800 tons of sulphuric acid. Work will be done by owner's forces.

Tex., Amarillo—H. W. Allen, Shamrock, recently purchased a 10 acre site and plans the construction of a cotton seed oil mill here. Estimated cost $250,000. Private plans.

Tex., Mirando—Wheatley Oil Co., C. A. Wheatley, Pres. and Gen. Mgr., Maverick Bldg., San Antonio, plans the construction of an oil refinery, 1,000 bbls. daily capacity, here.

Far West

Calif., San Francisco—Russia Cement Co., Gloucester, Mass., is having plans prepared for the construction of a 2 story factory for the manufacture of animal glues, paste and cement adhesives here. Estimated cost $40,000. S. Hyman, 68 Post St., San Francisco, Calif., is architect.

Calif., San Juan — Old Mission Cement Co., Standard Oil Bldg., San Francisco, appropriated funds for the construction of a cement mill including equipment, to increase the capacity here. Estimated cost $750,000.

Ore., Portland—George T. Mickle Lumber Co., North Portland, is having plans prepared for the construction of a paper mill at North Portland waterfront, to use refuse from present sawmill, capacity of sawmill to be increased from 300,000 to 600,000 ft. per 8 hr. shift. Estimated cost $1,000,000. Architect and engineer not announced.

Ore., Saint Helens—Saint Helens Pulp & Paper Co., awarded contract for the construction of a 2 story, 80 x 300 ft. paper mill to A. Gutherie & Co., Sherlock Bldg., Portland. Estimated cost $500,000.

Canada

Man., Fort Alexander—Manitoba Pulp & Paper Co., Ltd., Winnipeg awarded general contract for the construction of a pulp and paper mill here to Carter Hall Aldinger Co., Winnipeg. $1,500,000.

Ont., Port Arthur—Thunder Bay Paper Co. Ltd., is having plans prepared for the construction of a newsprint plant, 100 tons daily capacity. Estimated cost $1,000,000. Paper machinery, generators and motors will be required.

Ont., Sandwich—Canadian Salt Co., plans extensions to plant, including the installation of additional equipment for refining and handling salt. Estimated cost $40,000.